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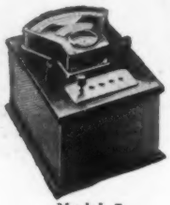

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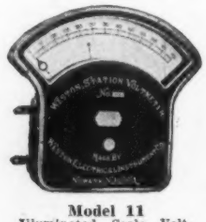

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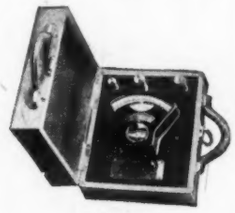

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Taking the Public Into Partnership

MOST men are willing enough to subscribe to the truth when expressed as a generality. Fewer are willing to act on it, especially when it requires the doing of something new or different from the usual. Public utilities are all willing enough to recognize that the public should be told in detail the truth about their problems and their needs. Many of them have been too timid in making their actions in this regard conform to their beliefs. One of the large central stations lately faced the necessity of increasing its rates. It did not remain satisfied with presenting its case to the state commission. It presented a report to the council of the city in which it operates, giving a complete account of what it proposed to do and invited examination of its affairs. In other words, the company put before the public that it served through the accredited officials the facts that made the change of rate necessary and asked that full consideration be given to them—that they be studied and understood. Such a policy must result in closer co-operation and better understanding between the server and the served. It should stimulate similar action by other central stations.

American Manufacture of Apparatus

AMERICAN skill can produce anything that can be produced elsewhere, but in pushing quantity production it cannot be depended upon to reach the highest standard. In this fact lies the usefulness of permitting free importation by license until this standard shall be reached and then giving the American manufacturer full advantage of a tariff high enough adequately to protect him. This, we believe, is a better project than forbidding importations of technical apparatus entirely and will be equally effective in jealously guarding American manufacture while holding it up to its best ideals. At present there is little indication of a dumping policy on the part of foreign competitors. As a rule their prices are quoted with very heavy increases to cover exchange, frequently reaching 200 per cent. Thus prices figure out at a large increase over pre-war figures for articles which are by no means certain to be of pre-war quality, as the experience of some importers has already shown. If American makers will but keep up the standards they are capable of reaching and have reached, they have, under a reasonable duty, little to fear from competition. As to things not made here of kind or quality obtainable abroad, there seems no reason for applying any duty at all pending the provision of a suitable American supply. The proposed English scheme of importing by license in such cases strikes us as a good one, being effective and flexible. This country ought to produce everything that it can require in the line of technical apparatus. As a mere matter of convenience the American-made article is to be preferred, and the only important requirement is that it shall be made available; but, as the British manufacturers themselves point out, a tariff alone will not insure meeting this desirable end. Either a tariff or complete prohibition with suitable provision for importing by license will tend to hasten American independence in research.

Research in Pure Science

THE recent announcement of the resignation of Dr. Ernest Fox Nichols, an eminent physicist, from the faculty of Yale University is of more than passing interest. Professor Nichols has accepted the post of director of pure science in the Nela Research Laboratories in Cleveland. In his letter of resignation from Yale he made the following statement: "The position offers complete freedom in the choice of research problems and places at my unhampered disposal such human and material resources as no university I know of can at present afford." This is but another indication of the changing trend in the advancement of science. Our institutions of learning are more and more hampered in the promotion of pure research by the lack of high-grade men and material resources, while large industrial organizations find it to be more and more to their advantage to broaden the scope of knowledge in certain directions vigorously and systematically. They are doing this by drawing into their organizations the best available men and by offering them almost unlimited resources. There can hardly be any regret over this irresistible development, provided that the change is not too rapid and that the scientific achievements which are thereby made possible will in the course of time become the common property of all humanity. In this way only can the new method accelerate progress in research in the pure sciences.

Interest During Construction

IN ANY engineering project occupying considerable time in its execution the interest charges during a period of construction may become somewhat serious. Delays after the capital required is out and bearing interest are particularly unfortunate, and the necessity of getting earning operations under way is obvious. A rather striking series of graphical demonstrations showing the bearing of this interest factor on the enterprise under various conditions are given in this issue by Page Golsan. He shows that on a million-dollar project the cost of delay at present rates will run to about $200 a day, so that slow shipments, unfortunate halting in construction and failure to get the works into operating condition promptly entail loss that may really make a serious difference in the early showing of the enterprise.

The secret of success is to shorten the whole construc-

tion period, to start the various portions of the work so that the completion of each part just when needed will neatly interlock with the progress of the structure as a whole, to arrange payments so as to incur the smallest possible additional interest charges, and finally to get earning operation at the earliest possible moment. The first requirement shows that there must be keen balancing between the cost of hurrying the work and the cost of delay. The engineer at this point is between the devil and the deep sea. If he tries to get ahead too fast, money will be wasted through the increases of cost entailed in rushing the work. If he moves too slowly, the interest charges will run on. Co-ordination of the various portions of the work is evidently a paying proposition, for when the work completed and on which payments are due is held from usefulness while another portion of the work is going on the interest charges count heavily. To obtain the necessary capital as needed is part of the fine art of the financier. Every dollar not borrowed too far ahead of time means a saving of interest, yet the funds must be always in sight and ready for prompt payment.

Distribution Under Difficulties

A RATHER striking illustration of the ingenuity that has to be exercised in dealing with novel conditions of distribution is given this week by Messrs. Gray and Hagenlocher in their account of the distribution problems involved in the construction of the government nitrate plant No. 1 at Sheffield, Ala. This great nitrate plant, more or less experimental in its character, required an electrical distribution of a decidedly unusual nature. In the first place, a very large proportion of the electrical output had to be used in form of direct current for variable-speed units acutely needed for the experimental work in hand. Since turbine-driven direct-current generators of the necessary size were out of the question, the alternators were wound six-phase and for the voltage required for the rotary converters.

The main operating plant had to be divided into three independent units so that the chemical process could go on with little interruption even in the case of a breakdown in one portion. The switchboards were massed together in a steel and glass room to protect them from moisture and fumes, and each motor could be operated from a push-button station alongside or from the switchboard, as the occasion required. The whole wiring system for the major part of the plant had to be planned with reference to resisting acid fumes, and the main busbars were run outside the building. In the portions of the building most exposed to fumes were alternating-current motors with acid-proof insulation and a distributing system consisting of flexible armored wire, acid-proofed before and after installation. Even the lighting fixtures in some instances had to be vapor-proof. The general direct-current system from building to building was put under ground with permanent provision for draining the manholes. In addition to the working buildings a whole town had to be built for the working force, lighted and provided with telephones, and systematic floodlighting was applied to the boundary fences, leaving no part of the outside unilluminated. Finally, as an additional unusual feature in the general wiring scheme of the plant, the temperature had to be known at about two hundred different points, and a central office in the switchboard room provided indicator boards for all of these points. This is a mere outline of some of the features of what in its entirety furnishes an instructive account of an intricate distribution system of most unusual character, skillfully carried out during a war-time rush.

Power Transmission and Industrial Congestion

THE fourteenth census of the federal government, now being taken, is likely to lead to startling developments. Decade by decade the census has shown an increasing agglomeration of the population into the larger cities, and the present reckoning will emphasize this tendency in a way to give good ground for alarm. It is already evident that the sudden and enormous industrial development due to the war has been stripping the country of available labor and concentrating it in the cities to a menacing degree. The result has been a great diminution in the necessary agricultural products, a congestion of traffic, an unprecedented rise in the general cost of living and huge increases in rentals. As a result of these conditions labor, despite rapidly rising wages, finds itself worse off at the finish than at the start. What is most needful now is centrifugal action instead of the centripetal force which has lately been the main feature of industrial dynamics.

It is just here that electrical power transmission may find its really most vital field for usefulness by enabling industrial operations to be conveniently and profitably carried on wherever the power networks may reach. The best labor market under present conditions is not the sinister old ideal of a line of unemployed standing before the factory doors, but a condition in which labor has a better opportunity outside the cities than in them, and where power and transportation are available there is no reason why industries should not gradually become distributed. Electric roads now struggling vainly for passenger traffic in a territory stripped of population would find both freight and passengers and afford the necessary connections for shipping. Water powers, big and little, can be pressed into service for power supply to recoup industry for the rising price of fuel. There are already many examples of highly successful manufacturing plants, established under favorable conditions in small towns, taking advantage of these opportunities and prospering to an extent which would hardly be possible with a change of location. Fuel will cost steadily more and more, and its mere transportation is a burden of which the country as far as possible should be relieved. To make the most of the advantages of transmission a distributed load is highly desirable as against long lines with but a single market. To be sure, the mountain may electrically be made to come to Mahomet, but it is far better for the national prosperity that he should at least make an effort to go to the mountain. We published not long ago an account of the Spanish and Japanese projects for the general distribution of power, thus equalizing in great measure economic conditions over a widespread territory. That the spell is working there is abundant evidence. Only recently there was advertised in a London paper a water power in the Pyrenees suitable for industrial utilization. Have we less imagination or enter-

prise that we should be content to see the country grow up to underbrush and the towns dwindle, while manufacture crowds cityward and contends with industrial discontent? It is high time for manufacturers to consider what may be done to improve conditions which are rapidly growing intolerable. No country can long remain prosperous unless effort is made to utilize its full resources, and this cannot be done when the population is herded in limited areas making vain endeavor to live without production. It would be exceedingly interesting to know how large a proportion of the dwellers in any large center are actually engaged in productive labor, physical or mental, instead of living off each other, and to compare this proportion with the conditions in smaller communities. Distributed industry will afford the solution for many of our gravest economic problems.

Turbines for Low Heads

ONE of the standing difficulties in hydro-electric work is the suitable treatment of cases where the available head is unusually low. To begin with, one encounters the fundamental difficulty of obtaining proper speed without serious losses due to belting or gearing, and in the second place these low heads are extremely troublesome on account of the large proportional effect of moderate absolute variations in the head. A. Streiff's account of the hydraulic arrangement of a typical low-head plant recently installed will give our readers a very distinct notion of the improvements which relatively recent years have shown. The plant in question is on the Kalamazoo River and has a normal available head of only 12 feet (3.6 m.). Originally the equipment consisted of a single 750-kw. generator driven by seven old-fashioned wheels geared to a common jack-shaft. This plant was burned, one might almost say providentially, last year and has been replaced by the installation which Mr. Streiff describes.

The new plant contains three 72-in. (1.8-m.) vertical-shaft turbines giving 380 brake hp. each at 164 r.p.m. The turbines are of modified Jonval type, especially planned to give high speed. The buckets of the runner are but four in number and are drawn clear back to the hub instead of forming a ring carried by radial arms. Our readers will instantly recognize that with a wheel of this size under 12-foot head the output has extraordinary high speed compared with earlier turbine practice. The construction evidently is one difficult to design for the highest efficiency, but the figure reached under test for this type—a little better than 86 per cent—compares very well with the best wheels of the earlier days of hydro-electric development. The turbines have the so-called vacuum setting, in which they are placed high and the penstock is arranged so that it is under partial vacuum.

In the case before us the wheels are below ordinary headwater, but in operation the water rises to the under side of the concrete generator-room floor, from which it is excluded by a stuffing box, and entrained air is removed by a small water ejector. The actual vacuum obtained in this way amounts to 5¾ in. (14.4 cm.). Each machine is provided with an independent governor, and the generators of 400 kva. capacity each deliver power, three-phase, 60-cycle, at 2,500 volts, stepped up to 45,000 for transmission. The little plant is a singularly interesting example of modern low-head practice.

Measurement of Power Factor for Rate Purposes

MUCH attention has recently been given by central-station managers to the question of low power factors in their customers' installations. The cost of supplying electric power through a three-phase system to a consumer depends principally upon the following four things:

1. On the distance of the consumer from the generating station, or the distance over which the power has to be transmitted.

2. On the demand for the power consumed, both as to its amount and as to the time of day when the demand occurs. A given demand is much more expensive to meet at or near the peak of the daily load than at other hours.

3. On the power factor of the customer's load. The load created by a shop full of underworked induction motors is more costly to supply than that absorbing the same amount of energy from the system to supply incandescent lamps.

4. On the balance of the customer's load. A badly unbalanced load, such as may be developed by large single-phase devices, is more costly to supply than a balanced three-phase load taking the same amount of power.

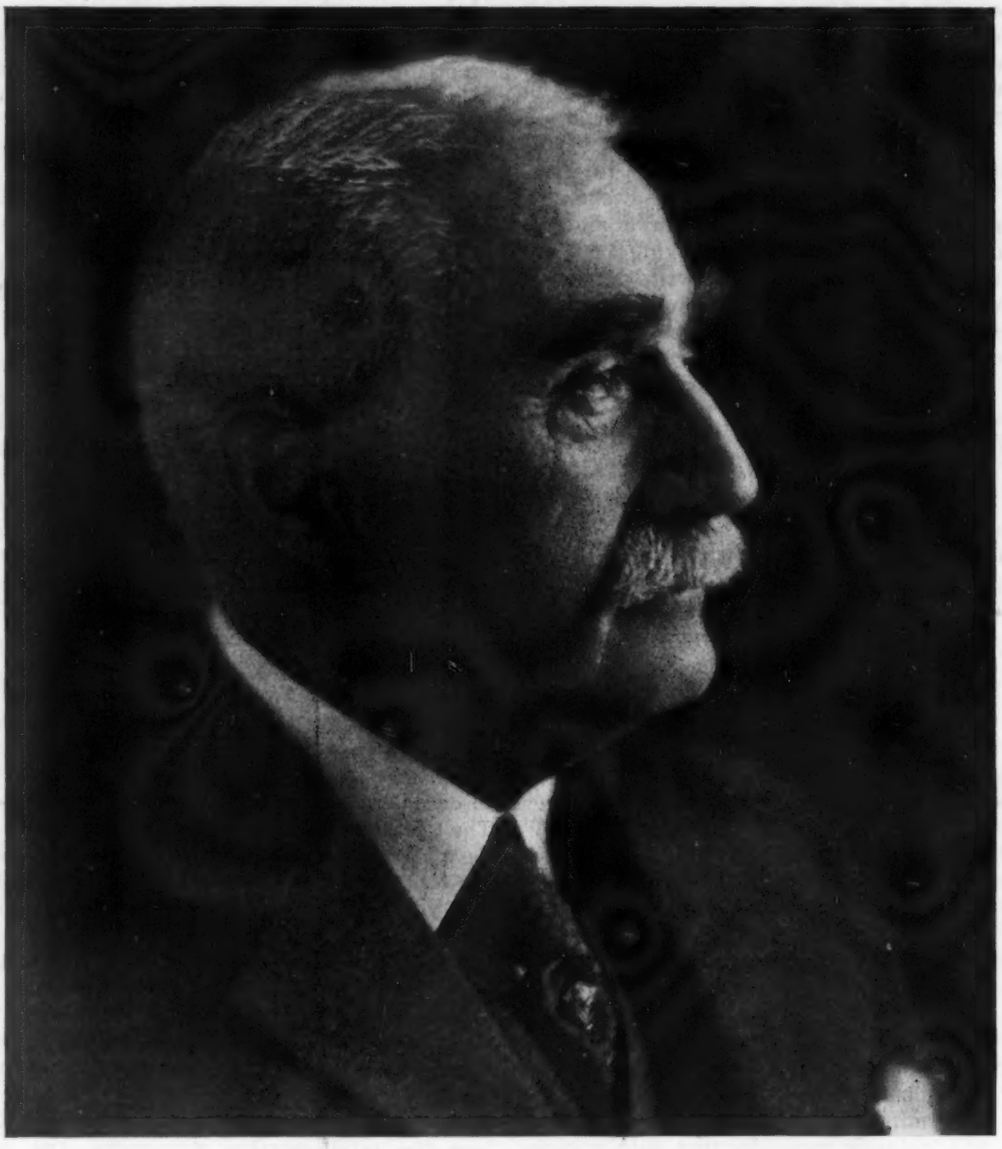
Experience over a number of years has enabled reasonable and generally accepted rates to be established covering the first two points—*i.e.*, the distance and the demand factors. There is, however, still a good deal of discussion as to the best methods of providing a fair overcharge in cases where the customer allows his load to develop a bad power factor or a bad lack of balance. The two errors are actually distinct, because a load may have a very low power factor and yet be balanced. On the other hand, it may have a very low balance factor and yet have a power factor which is quite close to 100 per cent.

This problem can be solved, as pointed out in a past issue, by using, in addition to the ordinary three-phase active watt-hour meter, a special three-phase reactive watt-hour meter which integrates the total number of reactive watt-hours applied to the customer's load.

The vector sum of the total active watt-hour reading and the total reactive watt-hours, the latter being treated as a j quantity, gives the total vector watt-hours absorbed by the load. The ratio of the number of active watt-hours to the number of total vector watt-hours is then the average power factor of the load during the entire time which is occupied by the registration.

This procedure is logically sound and mathematically correct for any three-phase system, balanced or unbalanced, provided that the two watt-hour meters are correctly calibrated and also that the voltages and currents of the system are sinusoidal. Except, however, in special cases, the discrepancy due to departure from sinusoidal wave form is not likely to be serious, and the procedure may properly be conventionalized for general use.

As soon as the meter makers are called upon to produce three-phase reactive wattmeters, they may be depended upon to supply an instrument with the proper constant and with a quadrature phase relation that shall not be dependent upon the maintenance of a balanced three-phase voltage.



Charles Francis Brush

To whose pioneer work in the field of arc lighting and generator design much of the later development of electrical apparatus can be attributed

ALTHOUGH a graduate mining engineer, Charles F. Brush at the age of twenty-eight returned to the field of his boyhood interest—electricity. The following year, 1878, he gave to the world the famous Brush system of arc lighting, which up to a few years ago was so widely used both in the United States and Europe for street lighting. It is noteworthy of the work of this pioneer that his various discoveries were of such widely practical value and have been so fundamental in the development of electrical apparatus. The Brush dynamo and arc-lighting systems are perhaps the most widely known of his inventions, but it is doubtful if they will prove of such lasting value to the electrical art as his contributions to generator design. To Mr. Brush is attributed the discovery of the use of iron laminations for generators. This in itself would be enough to perpetuate his name. Working in the days prior to the discovery of the utilization of alternating current, it is doubtful if Mr. Brush had an inkling of what this was to mean to future generations. To him also is attributed copper-plated carbon brushes and the damper winding in which a copper band is used between the field magnets and the coils surrounding them and what is more important the compound winding now so widely used on industrial current motors. He did much to develop and perfect the lead storage battery and secured many patents by which improvements in the manufacture of lead plates were effected.

In 1881 his achievements in the field of electric lighting were recognized by the French government, which decorated him as a chevalier of the Legion of Honor; in 1899 he received from the American Academy of Arts and Sciences the Rumford medal, "for the practical development of electric arc lighting," and in 1913 the American Institute of Electrical Engineers recognized his accomplishments by awarding him the Edison medal.

Mr. Brush is a member of a great number of scientific and engineering associations both here and abroad. Of late years he has devoted his time largely to his numerous business interests, but he still maintains at his home in Cleveland, Ohio, a well-equipped laboratory where he delights in spending leisure moments. Mr. Brush was born in Ohio, March 17, 1849, and at the age of twenty was graduated from the University of Michigan as a mining engineer.

Electrical Distribution at Nitrate Plant

How Electrical Energy Was Used at United States Government Nitrate Plant in Various Processes—Difficult Problems Were Encountered by Exposure of Apparatus to Chemical Fumes

By C. D. GRAY and E. HAGENLOCHER
The J. G. White Engineering Corporation

BUILT under the stress of war conditions and in the face of a very difficult labor situation, the government Nitrate Plant No. 1, at Sheffield, Ala., still conforms to the same rigid specifications prevailing in normal times. The construction was necessarily such that the chance of interruption at any vital part of the plant was minimized and great care was exercised in installing the apparatus which would be exposed to chemical fumes. Even in laying out the residence community for officers and workmen an electrical distribution system of a high order was decided upon.

When the government took over the plant of the General Chemical Company for the construction of Nitrate Plant No. 1 some of the apparatus had already been purchased and delivered. The first plan called for only two buildings besides the power house, and a direct-current supply had therefore been arranged. Later, upon expansion of the plans and when it became necessary to build a permanent dwelling community, a 2,300-volt alternating-current system was added.

The greatest amount of power required in the system was used for motors to drive fans, blowers, compressors and pumps. The remainder was used for lighting. No electric power was used for arc furnaces or heating furnaces of any kind as in the case of nitrate plants using other processes. By referring to the table it will be seen that the station has a generating rating of 5,000 kw., of which a considerable proportion was used in the ammonium process building alone.

In a previous article in the ELECTRICAL WORLD of April 5, 1919, by E. R. Welles and C. T. Mitchell, covering both United States nitrate plants No. 1 and No. 2, the location of these plants with reference to the characteristics of the particular section of the country was discussed and a general idea was given of the difference between the two plants.

Since the electrical features of the power house were

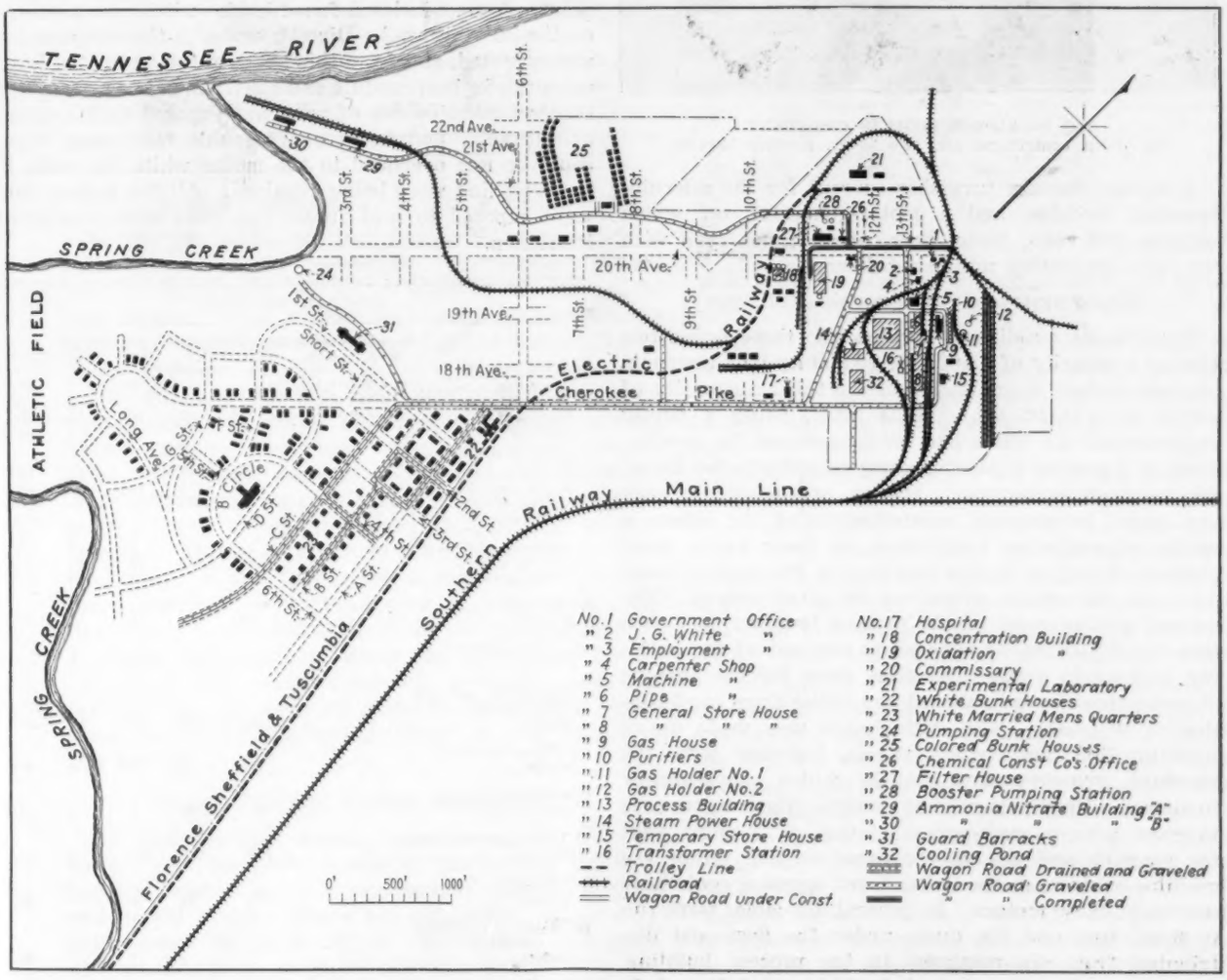


FIG. 1—LAYOUT OF UNITED STATES NITRATE PLANT NO. 1 AND DWELLING COMMUNITY

described in a paper by the present authors (ELECTRICAL WORLD, Dec. 13, 1919) they will be dealt with only briefly here. It will be noted from the table that the three rotary converters are of such size as to convert all of the alternating current into direct current. The direct current is required to supply variable-speed motors in the process building, and variable speed motors were necessary for the experimental work for which the process plant was built. The alternators were designed for 190-volt, six-phase supply in order to save the expense of transformers for the converters, also for the reason that turbine-driven direct--current generators could not be obtained of sufficient size for the requirements.

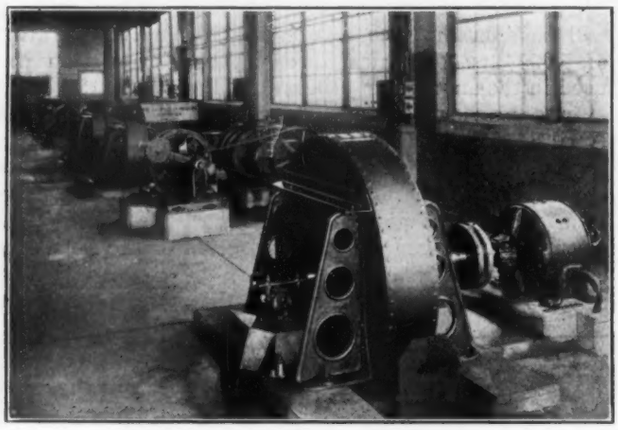


FIG. 2—BLOWER ROOM IN GAS PLANT
Six 40-hp. centrifugal and two 30-hp. positive blowers

A storage battery furnishes current for the solenoid-operated switches and a motor-generator set which supplies 220 volts, three-phase, at all times even with the main generating units shut down.

EQUIPMENT OF THE PROCESS BUILDING

The process building is divided into three units, two having a capacity of 15,000 lb. (6,800 kg.) of ammonia per twenty-four hours each and the third a capacity of 30,000 lb. (13,600 kg.). This plant, being a purely experimental one which had for its purpose the development of a process similar in some respects to the Haber process used in Germany, was so arranged that each unit could be operated independently of the other—a matter of particular importance, as there was a great element of danger in case one part of the system broke down or was unable to deliver its rated output. The general arrangement of the process building was such that the switchboards were all at one end of the building inclosed in a steel and glass room for the purpose of protecting the switchboard and cables from condensation or moisture. The switchboard was made up of incoming line and switch panels, together with the standard remote-control panels which are usually furnished with direct-current motors. Each motor was supplied with a push-button station at a point near the machine and one on the panel so that either the machine operator or the switchboard operator could have control of these motors. In general, all cables were run in fiber, iron and tile ducts under the floor and distributed from six manholes in the process building. These manholes were about 8 ft. high and 5 ft. x 5 ft. (2.4 m. x 1.5 m. x 1.5 m.) inside dimensions.

The nature of the process required that temperatures be accurately known at all times at more than 200 points, and for this purpose a central office of eight boards similar to a telephone switchboard was installed directly above the main switchboard. Cables had to be run from various points on the piping and apparatus to the switchboard room, and it was found best to install these in conduits hung from the roof trusses.

PROTECTION AGAINST FUMES IN ACID PLANT

The power in this building was used mainly for driving gas and air blowers and acid-gas fans. In laying out the electrical work inside the building it was realized that there would be a considerable amount of acid gas in the air and that this gas would be dissolved by the moisture, making a very destructive combination on such metals as iron, copper and zinc. It was decided, therefore, to run the main bus outside the building on steel cross-arms installed approximately 20 ft. (6.1 m.) above the ground and spaced 35 ft. (10.7 m.) apart, as shown in Fig. 3. At the corners of the buildings the cables were dead-ended on strain insulators attached to the middle of the arm and carried around the corner on pin insulators which are under no strain. This construction gave a good appearance and it kept all the wires at the same level except the jumper around the corner.

Each motor was tapped from the mains at the nearest point. A steel-inclosed fused knife switch was mounted on the building wall. Directly under it the compensator was mounted, and from this point to the motor the leads were run in iron conduit and steel. In this way only the shortest possible run of wire was exposed to the action of the acid, and in case of trouble temporary wires could be run overhead to the motor while the leads in the duct line were being repaired. All the motors that were exposed to acid fumes had coils with acid-proof insulation.

SUMMARY OF LOAD

	Installed Kva.	Active Kva.	Installed H.P.	Active H.P.	No. of Units Inst.	No. of Units Active	Current
POWER HOUSE:							
Generating	4,950	3,125	.....	....	3	2	AC
Rotaries	4,550	2,850	.....	....	3	2	DC
Auxiliaries	142	60	178	93	18	10	DC
Transformers	1,200	800	.....	....	6	6	AC
PROCESS BUILDING:							
Motors, unit No. 1	.....	....	1,089	549	22	11	DC
Motors, unit No. 2	.....	....	1,106	554	24	12	DC
Motors, unit No. 3	.....	....	1,658	1,075	26	13	DC
Generators, unit No. 1	75	75	.....	....	1	1	DC
Generators, unit No. 2	78	75	.....	....	1	1	DC
Generators, unit No. 3	150	150	.....	....	2	2	DC
Total motors	.....	....	3,853	2,178	72	36	DC
Total generators	300	300	.....	....	4	4	DC
GAS HOUSE:							
Motors	.....	....	345	170	10	6	DC
MACHINE SHOP:							
Motors	.....	....	44	44	3	3	DC
OXIDATION and ABSORPTION PLANT:							
Motors	.....	....	220	150	18	12	AC
NEUTRALIZATION:							
Motors	.....	....	15	7½	4	2	AC
CONCENTRATION:							
Motors	.....	....	21	14	6	4	AC
PUMPING STATIONS:							
Motors	.....	....	720	530	12	9	AC
ICE PLANT:							
Motors	.....	....	109	56	6	4	AC
RESEARCH LABORATORIES:							
Motors	.....	....	5	5	1	1	AC
Distribution transformers	908	891	.....	....	35	35	AC
Street lighting transformers	61	44	.....	....	4	3	AC

The lighting for this building involved some unusually difficult features on account of the acid conditions, the arrangement of the apparatus and the great height of the building. In this case the height was 90 ft. (27 m.) with no floors or galleries intervening, and the problem was to determine upon a method of construction which should require as little labor as possible both from first-cost standpoint and because of later replacements due to deterioration by the acid fumes. It was decided that the best scheme would be to use a good grade of flexible armored wire and dip this in an acid-proofing compound similar to pitch before installing. After being installed all the armor and clips were treated with compound again, to close up any cracks or abrasions that occurred during erection. The use of flexible cable eliminated the labor usually required for cutting and threading conduits and making bends and also allowed the use of less rigid means of support. On the roof tresses and on the steel work and side walls a very convenient method of fastening was used which eliminated drilling, as shown in Fig. 4. The advantage of this when working 90 ft. (27 m.) above the ground on planks placed between the roof trusses can be appreciated.

In the portions of the building where acid conditions were particularly bad the junction boxes and fixtures were made of aluminum and ground wires were installed as mentioned above, the idea being that the aluminum fittings would not need to be replaced while the wires could be renewed in a very short time without disturbing the rest of the installation.

The fixtures used were of the standard industrial type, steel-enameled with a cast-iron hood over the socket.

Vapor-proof fixtures were used only where small units could be utilized and where the replacement difficulties would be great.

CIRCUIT BREAKERS INSTEAD OF FUSES

In the gas house the switchboard is different from installations usually found in that carbon circuit breakers were used instead of fuses in the circuits of each motor. This represented quite a considerable saving in maintenance and very little if any additional initial expense.

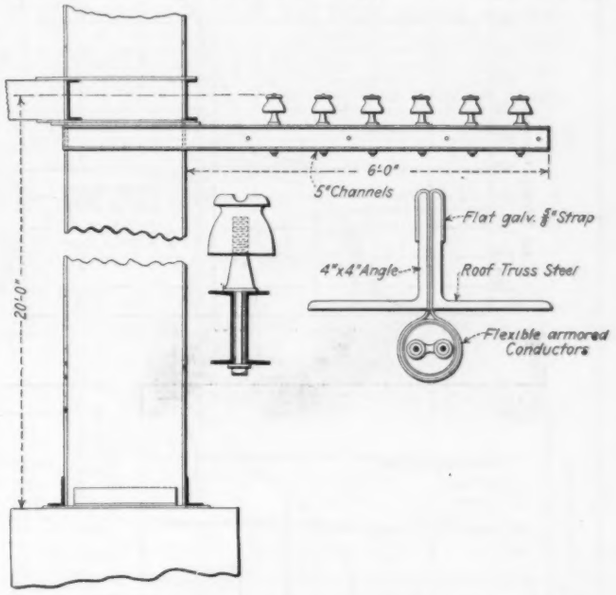
The pumping stations, acid plant, permanent community buildings and other outlying parts of the plant were at such a distance that it was not feasible to supply them with direct current. Therefore two banks of transformers, with a total rating of 1,200 kv., stepping up from the turbo alternators to 2,300 volts, were installed. This energy was distributed over wooden and steel poles. It was found that in some cases the structures carrying the overhead steam and ammonia pipes could easily be adapted to carry the electrical conductors. Telephone cables, signal wires and street-lighting circuits were also carried overhead. A ground wire was carried over the electrical wires in order to minimize disturbances from lightning, which is very severe in this section.

DIRECT-CURRENT CABLES UNDERGROUND

An underground system was chosen to transmit power from the power house to the various buildings supplied with 250-volt direct-current power, telephone and signal cables. There are altogether twelve manholes, about 150 ft. to 200 ft. (45 m. to 60 m.) apart, and between these manholes tile ducts embedded in concrete are run. The manholes themselves are sufficiently large to allow a man to stand erect with plenty of room for making splices. These manholes are made of reinforced concrete, and standard type of frames and covers were installed at the proper level for the proposed finished street grades.

The duct lines were graded to three different points in the system so that any large quantities of water collecting could be drained out of these points. This is the minimum number of points to which water could be drained on account of the great distances and contours. In addition, it was necessary to keep the conduit runs at the proper level to avoid interference with air gas, water and sewer mains which were installed at a later date.

At the bottom of each of the manholes a sump pit or depression was made approximately 12 in. (30 cm.) square and 6 in. (15 cm.) deep, which collected the



FIGS. 3 AND 4—SUPPORT OF BUSES OUTSIDE ACID PLANT AND SUSPENSION OF CABLE FROM ROOF TRUSS

moisture and allowed the workman to stand on dry concrete. U-bolts were installed in the forms before the concrete was placed and were of considerable value in attaching the snatch blocks and other cable-pulling rigs.

In the pumping station are installed three 150 hp. 2,300-volt motors driving centrifugal pumps and also a 10-hp. sump pump. On account of the shape and small size of the building there was not sufficient room to make a good open-wire layout of the 2,300-volt circuits inside the building, so triple-conductor cable in conduit was used in order to get a compact and safe arrangement. This was especially advantageous where the circuits had to cross each other. The circuit feeding the pump was carried down in 2½-in. (6.3-cm.) conduit and run as a header over the compensators. Disconnecting switches were installed so that each starting outfit or motor could be worked on without danger and without opening the main disconnecting switches.

The construction work, except the nitric acid plant, which was designed and constructed by the Chemical Construction Company, was done by the J. G. White Engineering Corporation, and all designs (with the exceptions of the special ammonia and acid processes) were made in conjunction with the Nitrate Division, Ordnance Department, U. S. A., and the General Chemical Company.

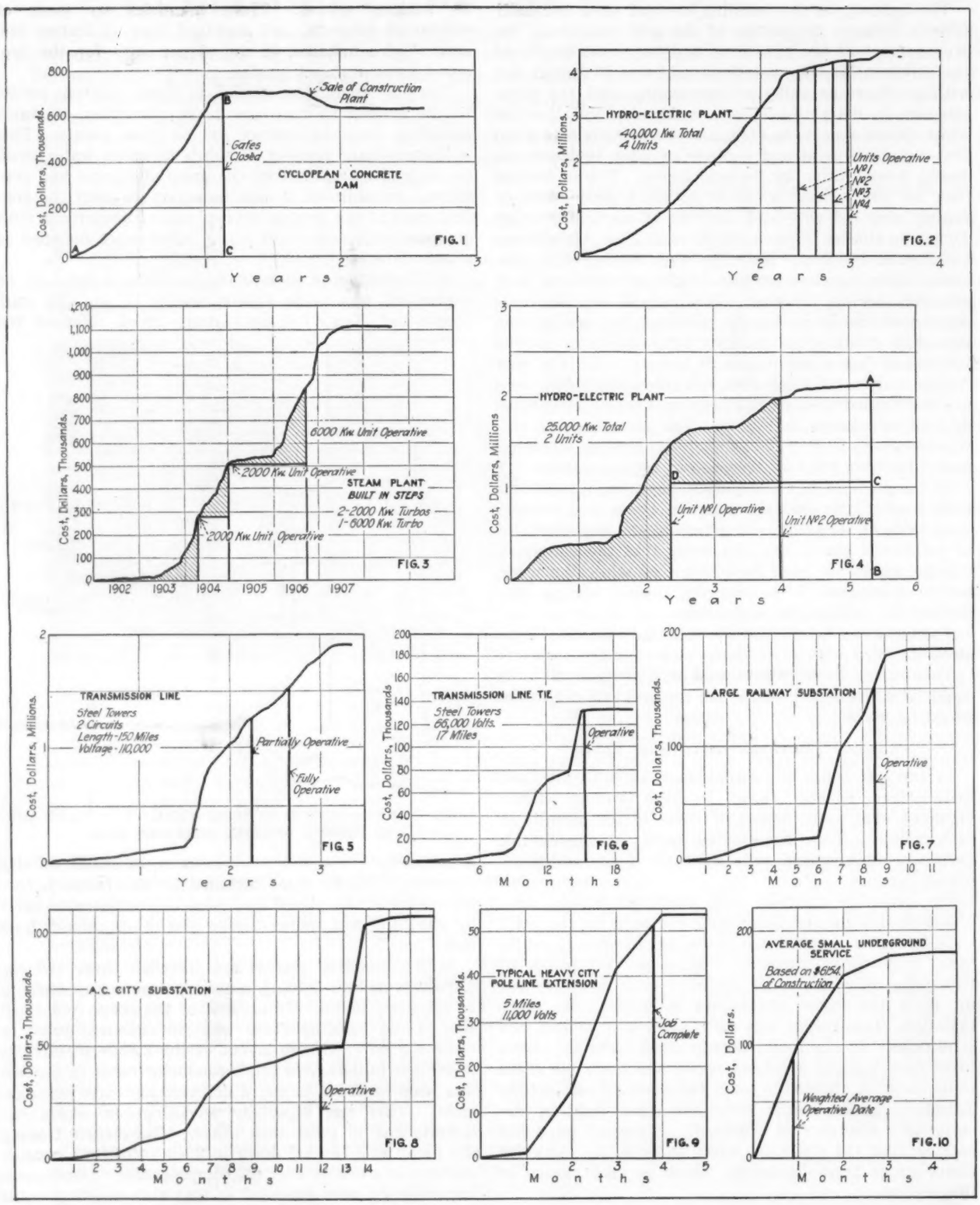


Fig. 1—Early sale of construction equipment after job is completed is economical, provided market conditions and other factors are equal.

Fig. 2—Showing economy of early completion of portions of a hydro-electric plant.

Fig. 3—Complete cost history of a three-unit steam plant. The shaded areas represent the interest during construction. It will be noted that final payments on the 6,000-kw. turbine were made after it had been placed in operation.

Fig. 4—Cost history of a two-unit hydro-electric plant. Work was stopped twice, as the curve shows, owing to a poor bond market. In the evaluation of this plant on the actual cost basis some question arose as to proper procedure. It was felt that an equitable solution was determined thus: Total cost of two units = AB. Apportion one-half of this cost, or AC, to second unit. Draw line DC as shown. Thus the shaded areas, as defined, were used as the "dollar years."

Fig. 5—Cost history of a transmission line, wherein the concreting of tower footings was carried out after the line was completed.

Fig. 6—Cost history of steel-tower transmission tie line.

Figs. 7 and 8—Showing payments for equipment after operation has commenced.

Figs. 9 and 10—Cost curves for heavy city pole line extension and for small underground service.

Interest Charges During Construction

Cost Curves for Hydro-Electric and Steam Plants and Transmission Lines Showing Factors Involved in an Economical Construction and Operating Program for Estimating and Valuation Purposes

By PAGE GOLSAN
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IN THE estimation of the cost of new construction or in the valuation of a physical property "interest during construction," among other overhead charges, must always be added to the so-called "bare" structural costs. In small jobs quickly completed this cost, expressed as a percentage, is small, and for this reason its importance in long-drawn-out construction is often neglected. Many large jobs have incurred interest charges up to 25 per cent and over, and in these days of high interest rates and expensive construction programs the question has assumed greater importance. Owing to the lack of published data based on actual facts, the accompanying curves will be of interest. In determining a percentage for interest during construction the annual interest rate should, of course, be first determined. If an entirely new project is being reported on, the cost of money to similar going concerns in the same locality may be easily ascertained and due allowance must be made for the unseasoned character of the securities to be sold. If additions are to be made to an existing utility, interest costs can be closely approximated from the market prices of present issues. For valuation purposes, on a "cost" basis, the past rates of interest may be usually obtained from the records. Bond yield tables will quickly determine the desired percentage in any of these instances.

The interest costs in any problem are:

$$I = rdt,$$

when I = interest costs, r = rate per year, d = dollars, t = years; or more simply:

I = rate (dollar-years).

The total cost of a project during its construction can be plotted as in Fig. 1. The expenditure of money starts at A, and the totals are as represented from time to time. At BC the expenditures are complete and the project is placed in operation. Calculus easily proves that the area ABC is proportional to the "dollar-years" of investment during this construction period. Whence

Interest during construction = $r \times$ area $\times$ constant

As an example to determine this constant for Fig. 1, let 1 in. vertically = \$600,000 and 1 in. horizontally = one year. Then if the area is obtained by a planimeter in square inches, the constant equals 600,000; that is, each square inch = \$600,000 $\times$ one-half year = 600,000 dollar-years.

The aim of an engineer in designing construction work should be toward the reduction of the dollar-year area. This may be accomplished by (1) shortening the period in its entirety, (2) starting various portions so that all parts will be finished just when needed and not sooner, (3) deferring payments where possible (and ethical), without incurring additional interest, and (4) bringing into use as much of the plant as possible at an early date. The program, however, must not increase costs, through hasty work, beyond the saving of interest.

The accompanying curves are based on expenditures as paid, and in reference thereto, for either estimation or valuation purposes, it should be remembered that favorable financing nearly always requires the sale of securities considerably in advance of construction. A further point that is often overlooked is that overheads incur interest as well.

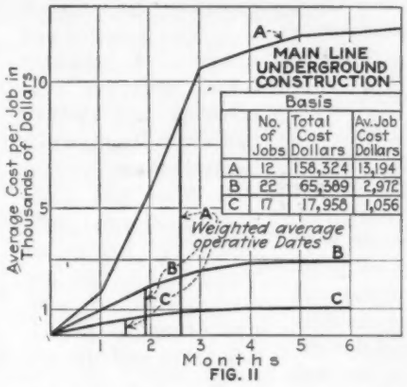

MAIN LINE UNDERGROUND CONSTRUCTION
Basis
No. of Jobs | Total Cost Dollars | Av. Job Cost Dollars
A 12 158,324 13,194
B 22 65,389 2,972
C 17 17,958 1,056
Weighted average operative Dates
Average Cost per Job in Thousands of Dollars
Months

FIG. 11

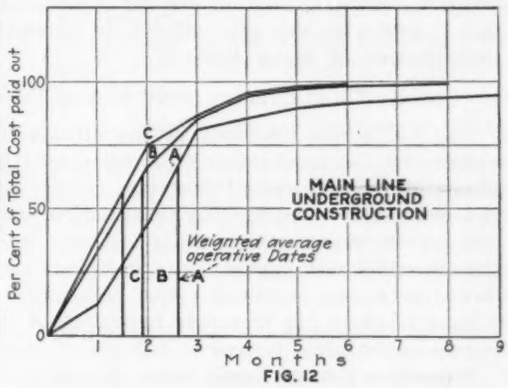


FIG. 12

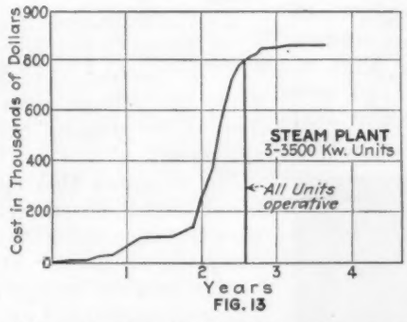


FIG. 13

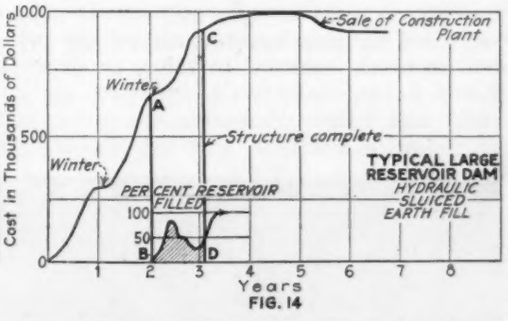


FIG. 14

Figs. 11 and 12—Identical data on underground work, the former being expressed in dollars of cost and the latter in percentage of cost. Fig. 11 would lead to the belief that a wide variation existed in interest during construction percentages between large and small underground jobs. Fig. 12, however, shows the divergency to be not so great as expected.

Fig. 13—A typical steam plant job. The first small expenditures are for engineering, the next series of payments being the purchase of the real estate and actual construction, undertaken about a year and one-half after first contemplation.

Fig. 14—Cost progress of a large hydraulic-sluiced earth-fill dam. The slacking up of work during the winter is clearly shown. The small inset, showing how this dam was used during its construction (as nearly all such dams may be if properly designed), presents certain difficulties to the valuation engineer in computing the interest during construction. From the inset of Fig. 14 it clearly cannot be held that all interest after the end of the second year is chargeable to operation, for the dam was incomplete. On the other hand, after a certain date all water was shut out of the temporary flume, and to all intents the structure was in full operation. The solution in this case was as follows: (1) Entire area up to AB-construction. (2) Determine the percentage that the shaded area of usage bears to the area of 100 per cent usage. Such percentage of the area $ABCD$ charged to operation, the balance to interest during construction.

Metal Deposition in Arc Welding—II

Mechanism of Metal Transfer from Electrode to Plate Is Explained by the Aid of Photography —Evidence Indicates that 85 Per Cent of Metal Is Carried Across Arc in Liquid Form by Molecular Forces

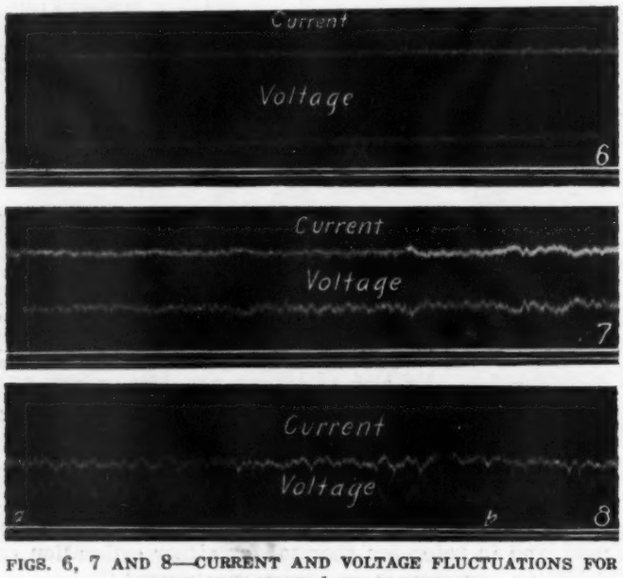
By O. H. ESCHHOLZ
Research Engineer Westinghouse Electric & Manufacturing Company

EVIDENCE that the passage of metal across the arc in metal-electrode arc welding results principally from simple molecular forces rather than from vaporization and condensation or from rapid gas expansion was offered in the first part of this paper, published in the ELECTRICAL WORLD of June 12. Further study of the problem is now presented, based upon oscillographic records of welding current and voltage, which corroborates the author's explanation of the mechanism of metal transfer, and the influence of this basic theory on the design of welding equipment and on welding operations is pointed out. Analogies are also offered to permit the ready visualization of metal transfer.

CIRCUIT CHARACTERISTICS OF METAL DEPOSITION

The variations produced in the circuit current and voltage by the mechanism of metal deposition may be observed readily upon inspecting oscillograms of arc characteristics when welding from a direct-current, 110-volt source, with a resistance ballast only in series with the arc. It is well known that a stable arc may be maintained with such a circuit. The resulting current and voltage reaction are therefore indicative of the stabilizing characteristics desired in circuits of special design.

When the rate of liquid metal deposition is low and the arc is sustained largely in an atmosphere of vaporized electrode material, arc voltage and arc current remain nearly constant in value, as shown in Figs. 6, 7 and 8 for, respectively, tungsten, carbon and iron (*a-b*) arcs. Upon increasing the energy concentration at the wire electrode terminal the end is liquefied,



FIGS. 6, 7 AND 8—CURRENT AND VOLTAGE FLUCTUATIONS FOR SHORT ARCS WITH ¼-IN. ELECTRODES

(6) Tungsten electrode (negative). Scale: Time, 0.33 sec.-in. Voltage, 71.8 volts-in. Current, 162 amp.-in. (7) Carbon electrode (negative). Scale same as Fig. 6, except that voltage scale is 71.8 volts-in. (8) Mild-steel electrode (negative). Scale same as in Fig. 7. No liquid metal was observed to have been deposited in period *a-b*. Rate of globule deposition 0.8 per second.

assumes a globular form, as discussed above, increasing in size and shortening the arc until, in long arc downward welding, its weight exceeds the retaining forces when the globule falls to the plate. Fig. 10 shows typical arc current and voltage fluctuations under this condition. A cycle of deposition appears to be as follows:

1. After forming the arc, appreciable time is required to liquefy the electrode end.

2. The liquefied end assumes a globular form, enlarges, decreasing arc length and arc voltage, while increasing arc current.

3. When the globule has enlarged sufficiently to bridge or short-circuit the arc stream, the arc voltage drops to practically zero and the arc current increases to short-circuit value.

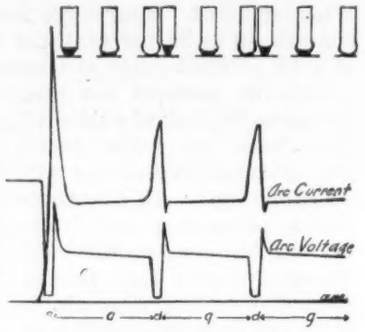


FIG. 9—CURRENT AND VOLTAGE VARIATION FOR CYCLE OF METAL DEPOSITION

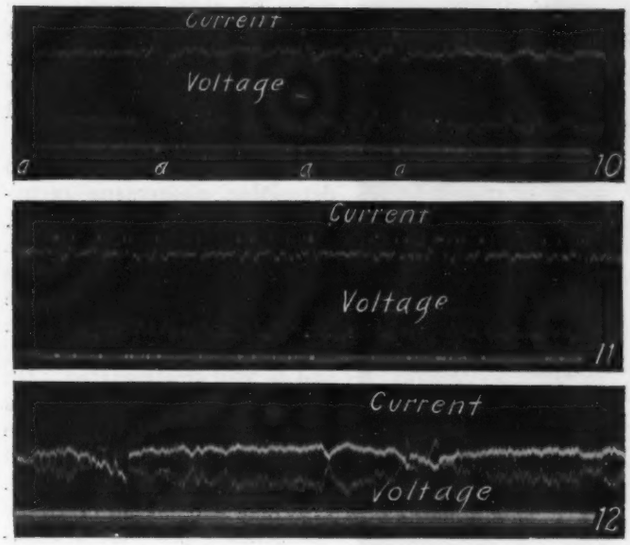
s, starting of arc; *g*, growth of liquid globule; *d*, deposition of globule.

4. The short-circuit condition exists until the globule is no longer in contact with the wire electrode.

5. At the instant of detachment the current decreases while the voltage rises sufficiently to re-establish the flow of the welding current in the partially deionized arc gases.

Fig. 9 shows this cycle graphically. Fig. 11 illustrates circuit characteristics upon holding a short arc with the same mild-steel electrode used in Fig. 10. The increased frequency of metal transfer is obvious, a smaller globule being required to bridge the arc gap. The contraction and expansion of arc gases due to this intermittent deposition produce a characteristic sputtering or "frying" noise; the frequency of the sound-wave impulses indicates the rate of metal deposition, arc current, arc length and electrode characteristics.

Upon welding overhead with a long arc very little metal is deposited. Figs. 5h (June 12) and 12 show the characteristic appearance of arc and the variation in arc current and voltage. Upon shortening the arc stream, however, Figs. 5g (June 12) and 13, molecular forces of attraction, discussed above, produce metal transfer. In Fig. 5g the globular electrode end may be observed in close proximity to the arc crater formed on the layer of deposited metal. The manipulative skill and metal deposition rate vary widely for different electrodes. A comparison of the downward and overhead deposition characteristics of a given mild-steel electrode may be obtained by a study of Figs. 14 and 15, while a comparison of the overhead deposition characteristics of two different mild-steel electrodes may be obtained on inspecting Figs. 13 and 15.



FIGS. 10 TO 12—CHARACTERISTIC OSCILLOGRAMS FOR VARIOUS ARC-WELDING PROCESSES

(10) Long-arc downward welding using mild-steel electrode. Scale same as Fig. 7. Deposition of liquid globules at *a* (rate about 2.4 per second). (11) Same as 10, except short arc length. Note increased frequency of deposition (rate about 25 per second). (12) Long-arc overhead welding, practically no metal deposition. Scale and electrode same as in Fig. 10. Appearance of arc shown in Fig. 5h. Rate of globule deposition, zero.

In view of these electrode characteristics, as well as others discussed in previous papers[1], the welding circuit should possess the following characteristics:

1. Ease of arc establishment when electrodes are cold.
2. Freedom from "sticking" or "freezing" of electrodes on short-circuiting arc stream.
3. Maintenance of a stable arc and approximate constant current value during growth of liquid globule.
4. Increase of welding current at instant and during the period in which the globule short-circuits arc stream. This is essential if adequate penetration is to be secured in short arc welding, the increased I^2R energy replacing to a considerable extent the arc terminal energy lost on short-circuiting the arc stream.
5. Rapid increase in arc voltage at instant of globule detachment for the purpose of facilitating the re-establishment of a stable arc.

The single operator set described in A. M. Candy's[2] paper incorporates these characteristics with the desired portability and efficiency, the complete unit occupying about half the space and having twice the efficiency of a constant-potential unit. Figs. 16, 17 and 18 show how this machine responds to the phenomena of metal transport, facilitating arc establishment, arc maintenance and deposit fusion.

ANALYSIS OF WELDING CHARACTERISTICS

The significance to the welding engineer of this analysis of metal transport is as follows:

A. An examination of the globular tips permits:
   1. Classification of electrode wires.
   2. Selection of electrodes which will produce a minimum oxide content, gas pockets and arc instability.
   3. A rough estimate of the arc length maintained by the welder.

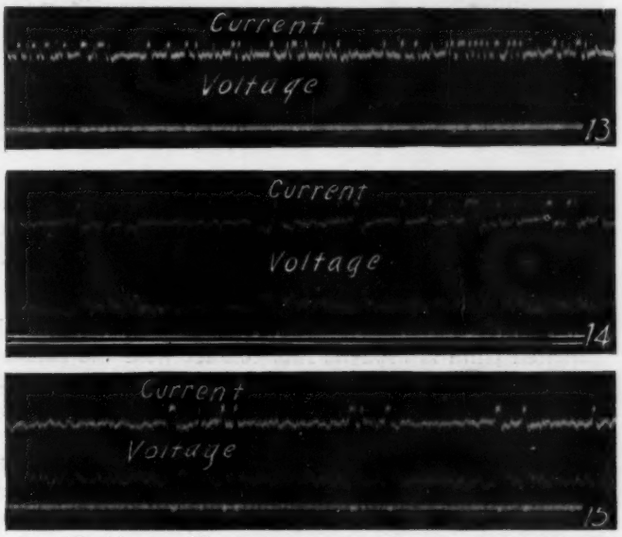
B. Use of a short arc length
   1. Retards the rate of oxygen penetration into the solid incandescent electrode metal beyond the arc stream.
   2. Increases the deposition rate. With some electrodes the increased force obtained on bringing globules in contact with the wetted plate surface after a short period of growth increases the deposition rate 35 per cent above that when maximum globular growth is permitted.

C. To facilitate overhead welding, electrodes must possess, apparently, the following characteristics:
   1. Small maximum globular formation.
   2. Stabilizing ingredients to facilitate re-establishment of arc after globular short circuit; freedom from occluded and generated gases.
   3. High-temperature gradient at junction of liquid globule and electrode, in order that the contact surface may be a minimum and the forces holding globule to electrode may therefore also be a minimum.

ANALOGIES SHOWING METAL TRANSPORT PROCESS

To convey an adequate conception of the magnitude of the forces producing metal transport, the author has developed a number of analogies employing the use of mercury and amalgamated surfaces:

Downward Welding.—A device for simulating metal deposition under this condition is shown in Fig. 19. Mercury is admitted into the upper end of a copper tube serving as the wire "electrode," flowing down slowly until it reaches the lower end. As this part of the "electrode" is amalgamated the force of surface tension causes a globule to form and enlarge until its weight exceeds the surface tension at the "electrode," when the globule drops to the plate and another proceeds to form. A constant stream of mercury may therefore be admitted at the upper "electrode" end and an intermittent globular deposition secured from the lower end.

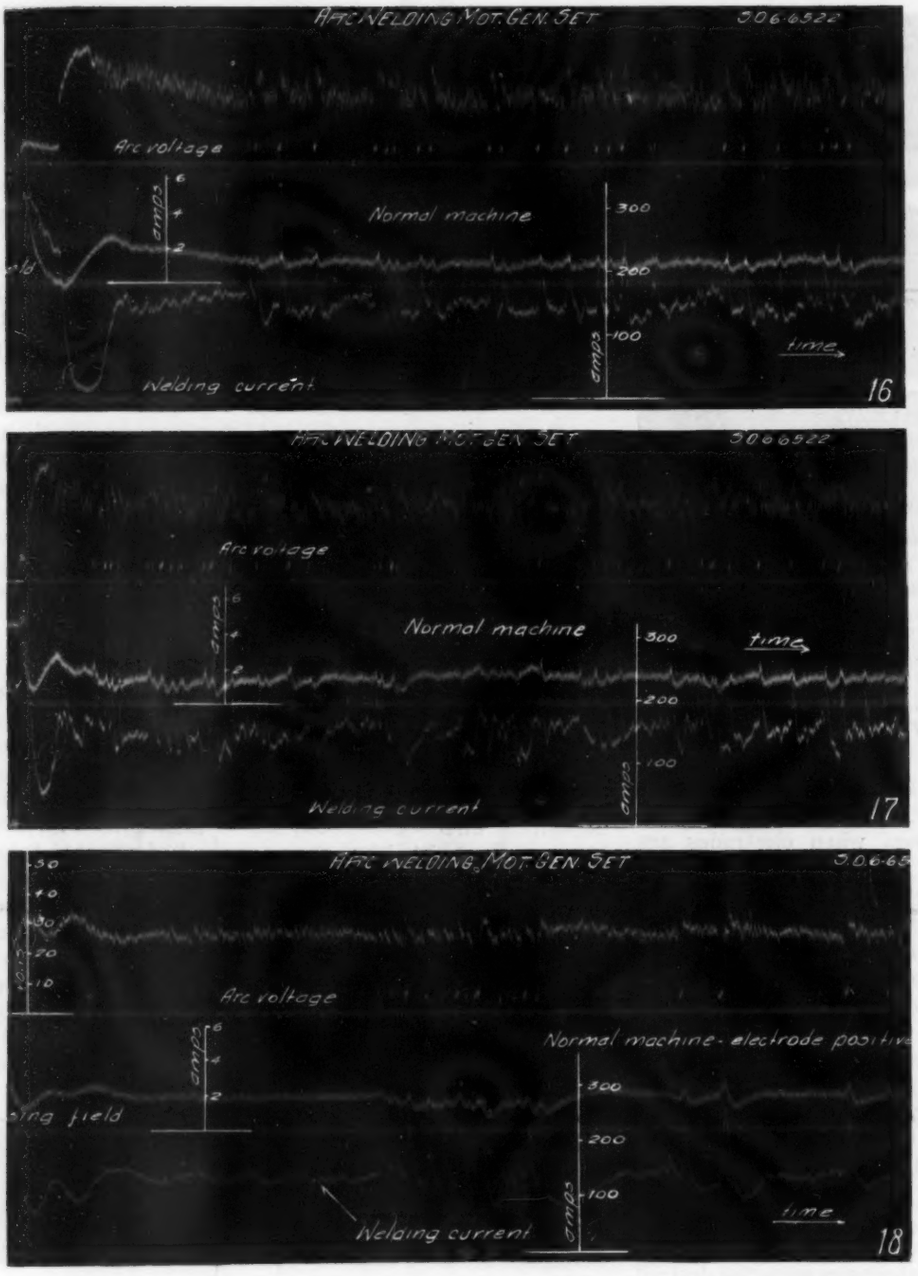


FIGS. 13, 14 AND 15—CURRENT AND VOLTAGE VARIATION FOR METAL ARC-WELDING PROCESSES

(13) Short-arc overhead welding, metal deposition as shown in Fig. 5*g*. Scale and electrode same as in Fig. 10. Rate of deposition approximately 28 per second. (14) Short-arc downward welding. Change in make of electrodes only. Compare with Fig. 11 and Fig. 15, globule rate, 13 per second. (15) Short-arc overhead welding, same electrode as in Fig. 14. Compare with Figs. 13 and 14. Rate of deposition, 6 per second.

[1] "Some Recent Investigations in Arc Welding," O. H. Eschholz, December, 1917, A.I. and S.E.E., pp. 714-717; "Training of Arc Welders," O. H. Eschholz, ELECTRICAL WORLD, Sept. 27, 1919, pp. 692-696.

[2] June convention 1920, A.I.E.E., "Characteristics and Performance of Arc-Welding Machines."



FIGS. 16, 17 AND 18—CHARACTERISTICS OF SPECIAL WELDING MACHINE DESIGNED TO FACILITATE STARTING OF ARC, DEPOSITION OF METAL AND ARC MAINTENANCE

(16) Arc current (lower) and arc voltage (upper). Electrodes, $\frac{1}{16}$ in. Bare mild-steel wire. Time, 0.37 second per inch. (17) Same as Fig. 16, excepting coated electrode used. Film speed, 0.65 seconds per inch. (18) Same as Fig. 16, excepting covered electrodes used. Speed, 0.33 seconds per inch.

Upon shortening the "arc" so that an inclined amalgamated plate is brought into contact with the surface of the enlarging globule, the forces of surface tension and adhesion at the contact area assist the force of gravity in detaching the globule. The increased rate of metal deposition by the use of a short arc may, therefore, be easily demonstrated. If a very short arc, $\frac{1}{16}$ in. (1.7 mm.), is held, the flow of mercury is continuous. This condition may also be obtained with welding electrodes, a very skilled operator having, to the author's knowledge, held for an appreciable time a 6-volt "arc" with a bare electrode. A similar condition may be obtained more readily, however, with heavily covered wire. The maintenance of such a continuous flow of metal on short-circuiting the arc stream greatly reduces energy concentration at the plate and therefore produces incomplete fusion of deposited metal to joint members.

Overhead Welding.—Metal deposition phenomena occurring on welding a vertical, inclined or overhead surface may be demonstrated with the device shown in Fig. 20. The end of the "electrode" tube in this case has a small opening and is not amalgamated. On admitting mercury into the connecting tube at a suitable height, a globule is formed on the end of the electrode. If a long arc is held or if the "electrode" end is amalgamated, globular growth will continue until the liquid surface ruptures, whereupon the metal flows down the electrode walls. The irregular or striated electrode contour shown in Fig. 5h was produced in this manner.

Upon shortening the "arc" to approximately $\frac{1}{16}$ in. (2.4 mm.), globule growth continues until contact is made with the wetted or amalgamated plate surface. (In practice this wetted condition is produced by the energy developed at the positive or plate arc terminal.) The globule then appears to leap upward. A similar phenomenon in overhead welding has led operators to conclude that the electrode metal "jumps" to the plate. This rapid transmission is caused mainly by the greater total surface tension exerted on the globule at the plate. The area of contact between globule and wire electrode is defined by the perimeter of the electrode. However, as the plate surface is relatively flat, liquid in contact with it may spread over a large area. Since the total surface tension is a function of the perimeter of the contact area, it is apparent that by a suitable selection of wire electrode size, current as well as arc length, the sum of the forces of surface tension, cohesion and gravity acting to hold the globule to the electrode end may be exceeded by the combined forces of surface tension and adhesion tending to lift the globule to the plate. In practice it is therefore found that overhead welding is facilitated by holding a short arc (small globule and low weight), reducing current from 150 amp. to 125 amp., with a $\frac{1}{32}$-in. (3.9-mm.) electrode (improved control in globular formation, decrease in wetted wire electrode surface and therefore total sur-

face tension and cohesion at electrode). A further reduction in attractive forces at the wire electrode is accomplished on decreasing the electrode diameter and current to respectively $\frac{1}{8}$ in. (3.4 mm.) and 100 amp.

The deposition characteristics obtained due to the expansion of occluded or generated gases may be demonstrated by trapping air in a $\frac{1}{16}$-in. (1.7-mm.) connecting tube. On varying the amount of confined gas and height of mercury column, either the pellet discharge or a slow globular enlargement, terminated by rupture, may be duplicated.

Although the knowledge concerning the behavior of the welding arc is still incomplete, the hypothesis that metal transport is chiefly caused by the forces of molecular attraction facilitates the interpretation of important arc phenomena and offers as well a basis for the ordered determination of electrode requirements, apparatus design and welding characteristics.

High-Speed Wheels for Low-Head Plants

Old Low-Head Plant with One 750-Kw. Generator Geared to Seven Wheels Through Jack Shaft Replaced by Three High-Speed Water Turbines Direct-Connected to Three 320-Kw. Generators

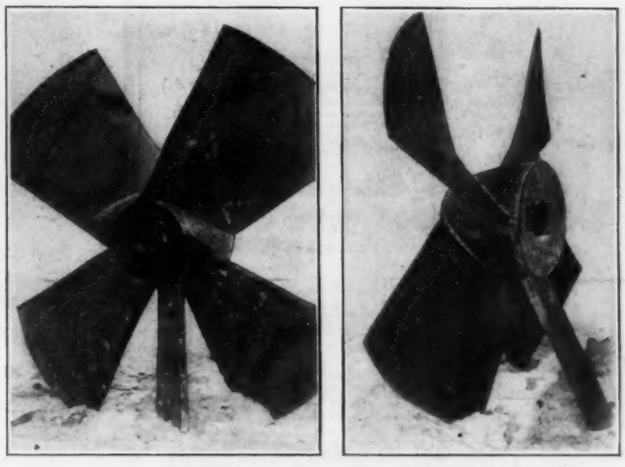
By A. STREIFF
Fargo Engineering Company

A HYDRO-ELECTRIC plant that is probably the first of its kind has been placed in operation by the Consumers' Power Company near Plainwell, Mich. This station contains three Allis-Chalmers high-speed runners of the latest type and has the further unique characteristic that the headwater over the turbines is raised and the turbines therefore may be classed among those installations which are known as "vacuum turbines."

Originally there had been a hydro-electric station on the same site, which is on the Kalamazoo River, 2 miles (3.2 km.) below Plainwell, Mich. It had consisted of a timber penstock, earth embankment and gate spillway. The head was 13.5 ft. (4 m.). Seven old-type wheels geared to a jackshaft were operated in the timber flume and were coupled to a single 750-kw. generator. This old plant was destroyed by fire on May 20, 1919, and the penstocks were then rebuilt in concrete. The new generating units delivered power for the first time on Jan. 28, 1920.

In the new plant there are three penstocks each of which contains a 72-in. (183-cm.) Allis-Chalmers type NX turbine, operating at 164 r.p.m. and delivering 380 b.-hp. under a head of 12 ft. (3.6 m.). This type NX turbine as developed by F. Nagler constitutes a very material advancement in turbine design. The tendency in this design has in the last decade more and more approached the Jonval type, showing a constancy of discharge at various speeds. The previous important stride in the design of high-speed runners was made by Professor Zowski, whose high-speed runners of a type characteristic around 100 are even now unsurpassed. These Zowski runners have all the characteristics of the Jonval turbine and even at high speeds approach the characteristics of Fourneyron turbines. The turbines of the Plainwell dam have been designed entirely along the lines of the Jonval turbines and show at increasing speeds the characteristics of the Fourneyron turbines. The result is that much higher speeds have been attained by this type NX turbine than is possible by any other type.

At full-gate opening the Plainwell turbines show a type characteristic of 143. The runner is an entire departure from the Francis, or the so-called mixed-flow, turbine and is of the Jonval type with important innovations. The arms of the old Jonval turbine to which the bucket ring was fastened are eliminated entirely and the buckets drawn back to the hub. The reduction of the number of buckets previously applied in high-speed runners is here carried to the limit. The number of buckets or blades has been reduced to four, and these four are spaced wide apart, so that the buckets and clearance between buckets each occupy about one-eighth of the total projected area of the runner. In this manner a very high-type characteristic has been obtained.



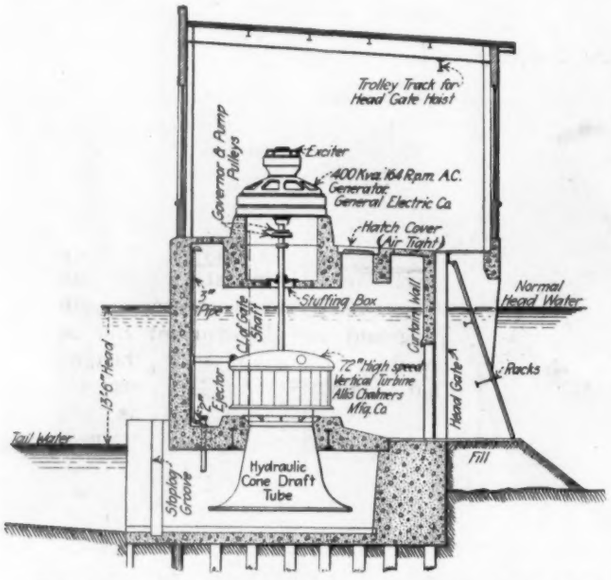
TWO VIEWS OF NEW TYPE OF RUNNER FOR HIGH-SPEED, LOW-HEAD TURBINES

As to the efficiencies that may be expected from such a high-type characteristic it is evident that the efficiency of high-speed runners of the Zowski design has not yet been fully attained. These Zowski-Leffel turbines, as finally developed by F. B. Fish, have given at Holyoke an efficiency of more than 92 per cent, whereas the type NX turbine at the present time shows a maximum Holyoke efficiency of 86 per cent to 87 per cent.

The accompanying illustration shows a view of the runner which has the general appearance of an ordinary propeller. It is made of cast iron. The wide openings between the buckets are of great advantage from an operating standpoint, as it is impossible for the wheel to become clogged by trash. The runners are placed in turbine cases of the ordinary design.

This type of turbine requires a draft tube of as great length as possible in order to attain the necessary efficiency. The draft tube made of steel plate is a flaring cone with vertical axis of the hydraucone type designed by William M. White. In this case the outline closely approaches the theoretical ideal draft-tube forms, the calculations of which were given by Professor Prasil. The characteristic of this draft tube is that the distance from the tailrace bottom to the draft-tube edge is comparatively small and the flare at the lower diameter is great.

On account of the large size of the turbine for the head and the high elevation of the center of the turbine case necessary through the required length of the draft tube, the wheel center in the Plainwell plant came too near the headwater to insure satisfactory operation in the ordinary way. It was therefore decided to use the so-called vacuum-turbine setting in order to provide



SECTION OF PLAINWELL (MICH.) PLANT USING NEW TYPE OF HIGH-SPEED TURBINES

The so-called vacuum-turbine setting is used, being sealed off by the curtain wall. Air is removed by the 2-in. ejector.

sufficient depth of water over the turbine. These vacuum turbines were introduced for the first time by the Escher-Wyss Company of Switzerland, and several installations have been made in which the turbines were installed in whole or in part above headwater and operate in a partial vacuum. The Plainwell turbines are still under the ordinary headwater, but the water level over the turbine when operating is raised about 6 ft. (1.8 m.) above headwater in the pond and rises to the underside of the generator-room floor, the entrance being sealed by a curtain wall. This concrete penstock, therefore, is entirely closed and operates under a partial vacuum. The air is constantly removed by means of a water ejector of small size. Its water consumption is insignificant compared with the discharge of the turbine.

After the plant was placed in operation the vacuum was tested and found to be 5¾ in. (13.3 cm.) at normal pond level, which showed that the penstock was full of water to the underside of the generator floor. The turbines have not yet been tested but are fulfilling power guarantees.

An interesting feature in the general appearance of the plant is the unusually small size of the generator as compared with the size of the turbine. Usually the generator for such a low-head plant is of quite large diameter. The small size of the Plainwell generators is due to the high speed of the turbines, and this permits the economical use of direct-connected exciters on top of the generators.

The generators are 400-kva., 320-kw., 0.8-power factor, 164-r.p.m., 2,500-volt, three-phase, 60-cycle machines. The thrust bearing is a General Electric Company combined spring-thrust and guide-bearing type. The machines are provided with alarm thermometers and oil gages to control the oil level in thrust bearings. The governors are Woodward governors of 6,700 ft.-lb. (924.6 kg.-m.) capacity and belted to the turbine shaft. At times of low water one or more of these machines may be used as a synchronous condenser to improve voltage conditions on the company's transmission lines. This is possible in this type of unit because no bearings depend on passage of water through the wheel for lubrication or cooling.

The oil switches are equipped with disconnecting switches for inspection purposes, in accordance with standard practice of the Consumers' Power Company.

There will be three type H 60-cycle, 400-kva., 45,000-volt primary, 2,500-volt secondary, oil-cooled, single-phase outdoor-type transformers. The 40,000-volt high-tension switch is also rated at 400 amp. This is mounted on a pipe framework, will be automatic and hand-operated, and will be provided with bushing type current transformers so as to operate the necessary relays. The entire plant is operated by one man on each shift.

At the Plainwell plant the hydraulic structures were designed by the Fargo Engineering Company of Jackson, Mich. J. B. Foote is chief engineer of Consumers' Power Company and W. W. Tefft is hydraulic engineer.

Electrical Development in China

ACCORDING to the *Transpacific*, there are only 168 electrical undertakings in China, forty-nine of which are under foreign management. The Japanese have invested over $100,000,000 in such enterprises through the South Manchurian Railway Company and $759,000 through other concerns, and the British have invested $25,000,000, of which about half is through Chinese concerns. In Canton there are twenty-two power and light companies in addition to the British Tramway Company. No water power is used, most of the power being derived from oil, except for two coal-burning plants. They are all small, only four having a capacity of over 1,000 kw. There are also twenty-two electrical enterprises in Kiangsu Province, centered around the city of Shanghai, which develop twice the power of the Canton plants. All of them use steam power.

Of the fifteen electrical companies in Shengking Province, Manchuria, thirteen are managed and owned by the Japanese, and the 30,000 kw. of power generated is supplied to Chino-Japanese industrial or transportation enterprises. The largest single enterprise is a power house of the railway company, which generates 4,500 kw. by steam. Although Shantung Province is one of the most populous areas in China, there are but four Chinese and one Japanese plant, generating a total of but 5,000 kw. In the other provinces there are only the small native plants using gas power and operating on a very small scale. The possibilities for future development are therefore very great.

"I Thank You"

By S. M. KENNEDY
Vice-president Southern California Edison Company

THERE is a story told of a young man who was what might be termed a strenuous lover. On one occasion when embracing his sweetheart he fancied he heard something that sounded like a gasp. "Am I holding you too tight?" he queried. "No," was the young lady's reply; "all I ask is that you leave me breath enough to say, 'I thank you.'" Whatever else may be said, there is no doubt that this lady understood a fundamental principle, namely, that the best protection for present joys and the best assurance for the fulfillment of hopes for the future is a thankful appreciation for past favors.

Now, let us suppose you are an employee of a public service corporation, possibly just entering the business. You may have come to the company from the ranks of those influenced by prejudice and hostility toward corporations in general and all concerned with them. But, doubtless, you have personal ambitions—you desire to increase your usefulness to the company and you are striving to be recognized by the management of the corporation. If you are in this class, if you desire to reach the goal of your ambition in as little time as possible—in short, if you want to hold a trump card in playing the great game of success—then here is a message for you. Learn to retain breath enough at all fitting times to say "I thank you."

S. M KENNEDY

Some man of a mercenary mind once said that the four sweetest words in the English language are "Inclosed please find check." Be that as it may, sweetness does not draw all the prizes in life, and other attributes may be considered with advantage. After all, the envied man is the man who possesses personal power—the power to disarm prejudice and to dispel opposition, the power to win friends and to draw business. Find such a man and he will tell you that the three most potential words in the English language are "I thank you." If it's checks a man wants, then the checks will come more frequently and their amounts will be greater if the "I thank you" is never overlooked. If it's ultimate promotion to a high position an employee seeks, then one of the surest ways to draw the attention of superiors and create a favorable impression is to understand thoroughly the potentiality of the words "I thank you."

Most men know there is a proper time for everything, and the proper time to commence saying "I thank you" is not next year or next week, but now and at once.

> "Look to this day;
> For yesterday is only a dream
> And tomorrow only a vision."

An editorial writer, in a recent issue of a daily paper, published an article under the caption "The Thank You Club," thereby indicating that he realized some men and women were daily missing great opportunities. He said in part: "It's great, the 'Thank You Club.' No initiation, no dues, no long-drawn-out meetings and no reports. Any one can join, and so small a number as two make a quorum to do business. No stated meetings and no stipulated place of meeting. Anybody can start a 'thank you club.' Beats 'overall clubs' all to pieces, lasts longer, does more good and spreads sunshine. One carries the bylaws around in his head. The password is 'Thank you.' And that's all there is to the whole book of rules. That's all it means—the 'Thank You Club'—just a 'Thank you' for the little services performed daily as well as the big ones. A 'Thank you' is more appreciated by many people than a tip, which by some may be considered an insult. Start a club some morning—watch your club grow—good ideas spread. Try the club for one day. It may make you a life member, and the 'Thank yous' will increase and radiate like ripples from a stone thrown into a millpond."

The modern public utility organization is much like a great machine, and its employees are the cogs in the wheels which grind out the daily round of usefulness. But there one must stop in the simile. A machine itself has no thinking power and no initiative. A man or woman should possess both judgment and discernment and be capable of independent thought and action. Upon the proper use of these qualities depends the degree of ultimate success obtained.

The prosperity of a utility company hinges upon the kind of men who handle the details of its business. Do these men work together harmoniously and efficiently? Does the company as an organization endeaver to please its patrons and satisfy the public? Let us assume it does. Then there will be in evidence a spirit of courtesy and consideration between man and man and between the company and its customers. The more respect and consideration fellow employees have for one another, the greater will be the amount of kindly courtesy exhibited in daily intercourse. And the more a utility company aims to please its consumers, the greater amount of public confidence and good-will it must enjoy. The outward and visible sign in all this intercourse of a pleasing character is the frequent and consistent use of the words "I thank you," when prompted by the right spirit.

It is quite possible that some may ask what the proper time and place to say "Thank you" is and to whom it shall be said. A little practice will soon clear up all doubts in this regard. Some people may be surprised at first to hear the words addressed to them, but they will not be shocked. The words become sweet music to the ears of him who gives and of him who takes.

The time? Any time—in personal intercourse, over the telephone or through correspondence. The place? Any place where an opportunity is given to recognize the existence and assistance of another. The one? Any one—whoever does you a small favor or a big one; any one who serves you, either in a special manner or

along the lines of regular routine. "Thank you" is rarely out of place and almost always welcome.

Many individuals say "I thank you" because the words express their feelings and they like to use them. Some people feel "I thank you," but leave the feeling to be understood. Others there are who do not know the "I thank you" feeling and rarely use the words. But the "I thank you" gospel may be spread if it is consistently promulgated. Ideas are like nails—the oftener you hit them, the deeper they sink. Those who believe in the "I thank you" policy need not be discouraged if success does not immediately crown their efforts to convince others of its value. The idea will eventually sink in through persuasion, conviction or self-interest, if the hammering is kept up.

There is another angle of the "I thank you" idea which is not along the lines of policy or self-interest. It is that each of us owes a debt of courtesy and politeness to the fellow-men with whom we come in contact. Shakespeare has said, "Thanks to men of noble mind is honorable meed." We have no more right to be discourteous or impolite to our neighbor at home, to our fellow employee, or to those with whom we daily come in contact, than we have the right to hold a gun at their heads and forcibly rob them. On the other hand, if one finds it necessary to commit robbery, the average man is liable to forgive the robber if he does his unpleasant task in a polite manner and says "I thank you" when he has finished.

The fixed star of ambition is the eternal guide which beckons men on to the goal of success. Its light flashes from the desired haven of ease, comfort and affluence. The lives of successful men illuminate the pathway for those who seek the guiding light of experience. All successful men have not reached the goal through the same attributes or by the same means. But all signs point to the quickening power of courtesy and politeness. History demonstrates that most men who have climbed highest learned, when their feet were yet on the lowest rounds of the ladder, of a marvelous compelling power the use of which had an irresistible effect. The marvel was its simplicity, for this mysterious power was tied up in the use of the three modest words "I thank you."

Linking Up the British Empire by Wireless

THE long-contemplated plan to connect all parts of the British Empire by wireless telegraph has received fresh impetus through the issue of the report of the committee appointed by the government to formulate such a scheme. The committee's report, which is unanimous, recommends that the empire shall be linked up wirelessly by stages of about 2,000 miles each and that the system employed shall be that of the generation of radio-telegraphic energy by thermionic valves.

The scheme contemplates two main chains of wireless, one receiving dispatches from Africa and the other from Asia and Australasia, both with Cairo as their first station. For the first link of the first chain a connection would be made on the Poulsen arc system between Oxford and Cairo, which the Post Office Department has nearly completed.

The cost of the scheme is estimated at £1,243,000 and it is figured that there would be a loss of about £100,000 annually in the working of the system during the opening years.

Columbia's Six-Year Course for Engineers

COLUMBIA UNIVERSITY, New York, is calling attention to its engineering courses, which since 1912 have followed the plan of a three-year professional course preceded by three years of college work, including specified and thorough training in mathematics, physics and chemistry. In this way six years elapse between the high school and graduation in an engineering course. Many eminent engineers and technical instructors are in favor of college preparation covering this length of time, and it will be remembered that the committee on development of the Institute of Electrical Engineers reported and the Institute itself adopted a resolution declaring for a six-year course in electrical engineering, two years of this to be given to the study of the humanities. Dean George B. Pegram of the School of Mines, Engineering and Chemistry of the university asserts that, with the exception of the mining engineering course at Leland Stanford Junior University, the courses at Columbia are the only ones to meet this desire. While in one sense the Columbia school is a graduate school, he says, in another sense it is not. That is, it is distinctly not a course which adds two more years to the ordinary course, but rather one in which more time has been devoted in the first three years to an education in the humanities and in the fundamental sciences, its organization being along the same lines as that of the law school and other professional schools.

The three years of preparatory college training include—in addition to English, history, modern languages, philosophy and economics—mathematics through differential and integral calculus and elementary differential equations, general chemistry and qualitative analysis and very thorough training in general physics. The three years in the technical school are entirely taken up with professional studies, the time devoted to the special branch chosen increasing with each year. For instance, in the electrical engineering course, physics, mathematics, chemical engineering and mechanical engineering each consume more of the student's time the first year than does his electrical course proper, but in the second year almost one-half and in the third year fully two-thirds of his time is devoted to electrical engineering pure and simple.

President Nicholas Murray Butler, in discussing the plan of engineering education pursued by Columbia University, has dwelt upon the fact that fewer than 50 per cent of the students who enter engineering schools remain to graduate. "The clear differentiation in our present program between the undergraduate work and the professional school work," he says, "together with the deterring influence of the longer course upon those whose resolve is not firmly established, operates to collect in our professional engineering school a group of men of sound and homogeneous preparation, each of whom is there for good reason. The interaction of the minds of these well-selected students on one another is by no means one of the least important features of this arrangement, and the possibility of a much higher standard of instruction is obvious. As for those other students who may have spent one or more years in college looking forward to an engineering course only to discover that their real interest lies elsewhere, they are when in college in the very best situation for directing their attention to preparation for other fields of labor."

Readers' Views and Comments

Welding Structural Steel Work

To the Editor of the ELECTRICAL WORLD:

SIR: The article by H. B. Payne in your issue for June 19, page 1421, entitled "Welding Structural Steel Work," has interested us very much, especially as the Quasi-Arc Company made a similar demonstration of welding on structural work about twelve months ago. In this case one-half of a 20-ft. roof span was welded, while the other half was riveted, and the structure was then loaded on the center line until it failed—*under a load of 3,360 lb.* The riveted section buckled and spread, while the welded portion was practically intact.

D. C. ALEXANDER, JR.,
President.

Quasi-Arc Weldtrode Company, Inc.,
Brooklyn, N. Y.

Advantages of 50-Deg. and 40-Deg. Motors

To the Editor of the ELECTRICAL WORLD:

SIR: A number of articles have appeared in your columns during the last year or two on the relative advantages of the "continuous-rated" or 50 deg. C. rise motor versus the older "double-rated" or 40 deg. C. rise motor.

One claim frequently put forward by the advocates of the 50 deg. rise motor is the price advantage. A higher efficiency is also claimed since the use of the 50-deg. motor lessens the chance of over-motoring. These arguments are based on the economic advantages, and the writer wishes to point out that these advantages are often apparent rather than real. This fact was recently brought to his attention in connection with investigations of certain motor-equipped industrial plants purchasing power from a public utility company.

A particular load required 11 hp. almost continually. Either a 10-hp., 40-deg. (old type) or a 15-hp., 50-deg. (new type) motor could carry the load. The motor manufacturer quoted $275 for the "old" 10-hp. and $274 for the "new" 15-hp. motor, an apparent advantage of $1 for the "new" type. However, the power companies usually have a "stand-by charge" or "maximum-demand charge" that is based on the installation, which in turn is taken from the name-plate ratings. In the case referred to the "stand-by charge" is $3.25 per month per kilowatt of installed load ($2.44 per horsepower). The excess annual charges on the 15-hp. motor amount to $146.40, and this sum far outbalances any possible price advantage of the motor. This condition will often arise, and care is required that an apparent saving shall not result in an actual net loss.

On the other hand, however, if the load approximated 13 hp. to 15 hp., then a 15-hp. motor of either type should be selected, and a price advantage of approximately $50 makes the "continuous-rated" motor the most economical application as there is no difference in the "stand-by charge" in this case.

The manufacturers of the "continuous-rated" motor state that, for purposes of comparison with the "old" 40-deg. motor, one must take 83⅓ per cent of the continuous rating. Accepting this figure (although the opponents of the new method of rating assert this to be too radical and unsafe), a 5-hp. "continuous" would rate as a 4.2-hp., 40-deg. rise motor. Similarly, a 7½-hp. motor would be 6¼ hp. on the old rating. It is apparent that on a common basis of comparison there is now available a larger line of motor sizes to select from. For example, 4.2, 5, 6.25, 7.5, 8.3, 10 hp., etc. Those opposing the new system of rating will probably insist on reducing the odd-size ratings (*e.g.*, 4.2 to 3.5, say; 6.25 to 5.5 or less, etc.), as they take the position that 83⅓ per cent of the continuous rating does not provide the same degree of security as do the older ratings.

From the above facts the following conclusions are drawn:

1. There are now approximately twice as many motor sizes to select from as formerly.
2. Further experience is apparently necessary to determine the correct listing, on a comparative basis, of the "odd" (new) sizes.
3. With proper data as regards the load, motors can now be selected closer in size to the exact requirements.
4. In arriving at the most economical selection, in the case of purchased power, it is evident that the power rates as well as the price of the motor must be taken into consideration.
5. At present, with the two systems of ratings and with various power rates, it seems that there is greater chance for mistakes in selection than in the past, unless expert advice is relied upon almost exclusively.

L. H. RITTENHOUSE,
Associate Professor of Engineering.

Haverford College, Haverford, Pa.

Fire from Electrical Causes

To the Editor of the ELECTRICAL WORLD:

SIR: Referring to an editorial article that appeared in the ELECTRICAL WORLD for May 22 in regard to accurate reports of so-called electric fires, the writer would like to say that, like many others closely connected with the electrical business, he has frequently known of cases where fires were reported incorrectly in the newspapers as due to defective wiring. It should be the duty of every electrician to combat such reports, accepting the blame, however, when fires are actually caused by electricity, and using every effort to suggest and carry out means for future prevention.

In our experience several fires have been reported as "caused by defective wiring" when this was not the case. In one instance the electric service wires had never been connected to the building. In another the service wires had been cut off two years previous to the fire. In a third instance a three-story department store, lighted by gas only, had electric elevator service. During a fire this elevator was operated for twenty minutes to carry the women employees to the lower floors. The proprietor of the store told me later that the fire started in a packing room from a lighted cigarette. In another case investigation brought to light the fact that a chemicalized mop was left on the west side of a house on a hot afternoon in close proximity to a telephone ground wire. The sun ignited the mop, setting fire to the side of the house.

Many similar cases are known. In this city every effort is made to induce the reporters to give us a fair chance to investigate fires before ascribing them to electrical causes.

ISRAEL LOVETT,
City Electrician.

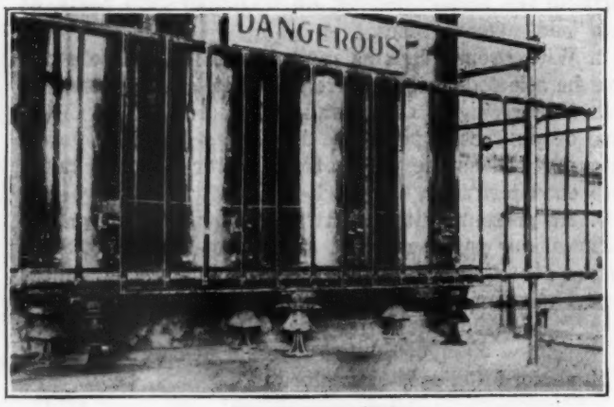
Omaha, Neb.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Pipe Frame Guards Lightning Arresters Against Trucks

TO PREVENT automobiles and trucks backing into a set of 33-kv. lightning arresters installed in an old boiler house now used as a central-station garage, a pipe guard was erected as illustrated. It consists of two 1¼-in. (3.2-cm.) pipe rails looped in front of the usual



PIPE AND STRAP-IRON GUARD PREVENTS TRUCKS BACKING INTO ARRESTERS

rail guard placed before the arresters, the former being connected by parallel iron straps ¾ in. (2 cm.) by 3⅛ in. (7.8 cm.) in section. The straps are spaced 6 in. (15 cm.) apart on centers and are 30 in. (76 cm.) long, being fastened to the rails by ¼-in. (6 cm.) stove bolts. The outer guard clears the inner one by about 15 in. (3.8 cm.) and has successfully resisted the impact of motor vehicles backing toward the arresters on more than one occasion.

Large Birds Are Found to Be Cause of Transmission Trouble

DURING the past year a number of short circuits on the 60,000-volt transmission line of the Southern California Edison Company from Kern River to Los Angeles were found to have been caused by large birds which roosted in the jumper loops. The bodies of the dead birds found underneath the towers gave an explanation of a number of line troubles which had been occurring for some unexplained reason. These birds, which were from 25 in. to 30 in. (60 cm. to 75 cm.) high, rested in the jumper loops of the dead-end towers where the clearance to steel arm was approximately 19 in. to 20 in. (47.5 cm. to 50 cm.).

In order to stop this trouble, and also another frequent trouble consisting in a flashover from the loop to the tower, it was decided to add another insulator to the string, bringing the total number on the dead-end strings to six and on the suspension strings to five. The trouble last referred to was caused by the formation of an arc between the main body of the tower and the jumper loop, which would rise until it spanned the insulator strings and caused the end units of the string to be broken by heat. As a general rule, service was immediately resumed over the line after the arc was broken, which was accomplished by lowering the voltage on the line. No definite conclusion has been reached as to the exact cause of this trouble, and it would appear that the clearance of 28 in. (70 cm.) should be entirely sufficient to insulate the line against any normal voltage.

Systematic Line Inspection Practiced by New York State Companies

IT WAS brought out very plainly in the discussions of line inspection methods at the recent Utica (N. Y.) meeting of the Empire State Gas & Electrical Association that practically all New York companies do have some system of inspection, unless there are special conditions involved. The period of inspection on poles averages about one year and high-tension lines are patrolled about once a week. Special inspectors are usually employed for the high-tension systems, but linemen are used for the distribution lines. In some cases distribution lines are being worked on so constantly that any troubles are caught without special inspection.

Inspections are made annually for the Schenectady Illuminating Company by an inspector who uses a blank form to fill in the conditions of the line as found. This type of man has been found very important, and an ordinary lineman has not given satisfactory service for this work, according to C. S. Van Dyke.

The Syracuse Lighting Company, S. A. Huntington said, has a system whereby one-half of its lines are inspected one year and the other half are inspected the next year. All butts of poles are carefully inspected in the spring after the frost is out of the ground. During the winter months the overhead-line condition is noted by the inspector. High-voltage lines are inspected very carefully each year by cutting the current off and making a thorough examination of the cross-arm, insulators, etc. The high-tension lines are patrolled every week.

C. H. Cross stated that the Solvay Lighting Company tested all pole butts, cross-arms and pins annually. It is the practice of the Utica Gas & Electric Company, according to W. J. Brady, to patrol the high-tension lines each week, but no regular inspection system is maintained for the distribution lines as they are continually being tested and inspected by the line gangs at work. The Empire Gas & Electric Company has no regular system of inspection at the present time on account of rebuilding its lines. On high-tension lines a patrolman is kept continuously busy on inspection work, P. Hoodman asserted. The Rochester Gas & Elec-

tric Corporation is another company that has no periodic inspection on account of joint ownership with the telephone company. With two different gangs working on the lines it is thought that the inspection work is automatically taken care of, although every six months the guys are gone over and tightened up, according to Sidney Alling.

While there is no regular systematic inspection, it is the endeavor of the Rome Gas, Electric Light & Power Company to go over the lines every year and to trim the trees each fall, stated A. B. Motor, in discussing his company's activities. The Elmira Water, Light & Railroad Company patrols the high-tension lines once each week, and linemen are used to inspect the distribution wires periodically, J. F. Creighton said.

The work of the Boston Edison Company is divided up into ten divisions, according to J. A. Vahey, who told of the work of this company. Each division has an inspector who is a lineman. While the lineman may occasionally err on the side of safety, that would seem to be a virtue rather than a fault. A card index of poles is kept, with a card for each pole, and the inspector's records are recorded on these cards. It is the policy of the company to change the oil in all switches and transformers once each year. High-tension lines are patrolled every day.

In discussing the practice of the Westchester Lighting Company, H. W. Watt said that the subject of maintaining the line system might be divided into two parts, the first being inspection to maintain the continuity of service and the second the record system. This company has 30,000 poles and an inspector is kept busy making the round in one year. Slips are made out by the inspector which really correspond to work orders. As these work orders collect, they are grouped into districts and the repairs are made at certain times. Each foreman of a district also keeps on the lookout for minor faults requiring repair. Poles are also thoroughly inspected by linemen before climbing them. The record system is kept up by the inspection department, and a check is made on all new work to see that it has been done in a thorough manner and to inventory the material that has been used. The Municipal Gas Company of Albany uses a lineman for regular inspection work, who enters his reports on cards. All poles, cross-arms, insulators, etc., are inspected, as well as the trimming of trees. This information is all entered in the pole-line book. The inspector, however, does not have the final word, but the foreman inspects the poles that are marked "bad" in the pole-line book and after his personal inspection marks the approximate date on which the pole should be changed. It is possible to cover the system twice each year with this method, stated A. Anderson.

The Adirondack Electric Power Corporation employs a regular patrolman who reports to the system operator. The system, however, is applicable more to the high-tension line than to the distribution line. There is no regular inspection on its distribution system, the line gang taking care of this work, L. R. Nichols asserted. W. J. Fox stated that the Fort Plain Gas, Light, Heat & Power Company had no regular form of inspection but considered that with three companies owning poles jointly the line work was well taken care of by the line gangs. The New York & Queens Light & Power Company has about 30,000 poles that are covered by an inspection system. At the time of erection the poles are dated for inspection at a certain time. When this time arrives the pole is inspected and the date is again set forward for the next inspection, which may be in two or three years. This method allows the inspection time to be shortened with the life of the pole and at the same time reduces the total inspection work to a minimum. In the opinion of W. C. Blackwood, who told of the work of this company, butt inspection tends to shorten the life of the pole. Linemen are not considered good inspectors by the company.

Chart Shows Turbines to Use for Different Loads on Plant

BY MEANS of a chart prepared by a large central station in the Middle West the power-house operator can tell precisely which of the different turbines in the station will develop a given load with a minimum steam consumption. In this chart, which is shown here, a curve is plotted for each size of turbine in the plant showing the steam consumption compared with the load. The following example illustrates the manner in which the curve is used:

Assuming a 60-cycle load of 18,000 kw. and a 25-cycle load of 19,000 kw., what is the most economical arrangement in machines to carry the load and how many

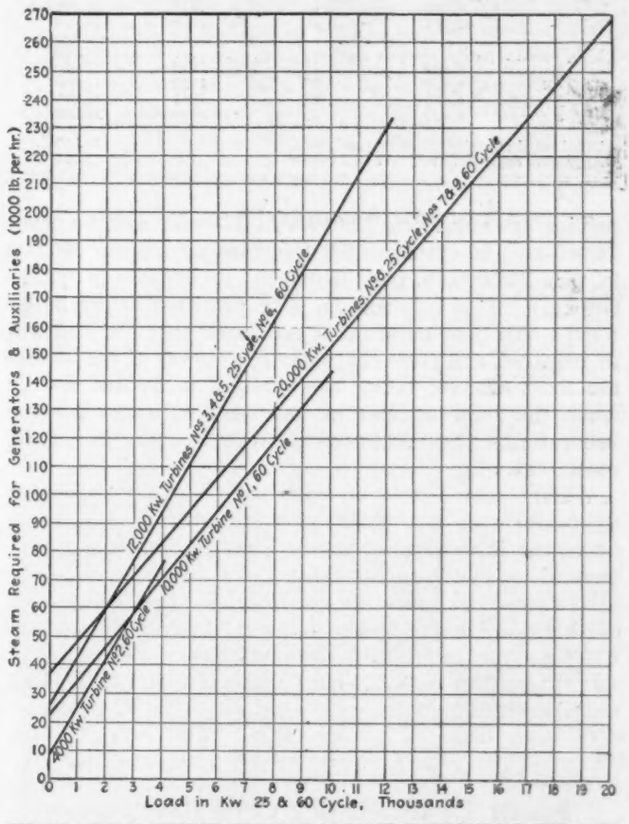

Steam Required for Generators & Auxiliaries (1000 lb. per hr.)
Load in Kw 25 & 60 Cycle, Thousands
12,000 Kw. Turbines Nos 3, 4 & 5, 25 Cycle, No 6, 60 Cycle
20,000 Kw. Turbines, No 8, 25 Cycle, Nos 7 & 9, 60 Cycle
4000 Kw. Turbine No 2, 60 Cycle
10,000 Kw. Turbine No 1, 60 Cycle

CHART SHOWS WHICH TURBINE IS MOST ECONOMICAL FOR ANY LOAD ON PLANT

Note that the 10,000-kw., 60-cycle machine consumes less steam than the 4,000-kw. unit on loads in excess of about 3,000 kw. A comparison between the 12,000-kw. and the 20,000-kw. turbines of both frequencies shows that the larger machines are the more economical for any load over about 2,000 kw.

pounds of steam per hour will be required? Taking the 60-cycle load of 18,000 kw., first find this load on the bottom of the chart and proceed vertically to the first intersecting line of a 60-cycle machine. This shows that a No. 7 or No. 9, 20,000-kw., 60-cycle turbine should carry the load, and by following a horizontal line to the left

side of the chart it will be found that 245,000 lb. (110,000 kg.) per hour is required by this machine under the load mentioned. By the same process it will be found that No. 8, a 20,000-kw., 25-cycle unit, should be used to carry the 19,000-kw., 25-cycle load and that the machine will require 256,000 lb. (116,000 kg.) per hour of boiler capacity. If for any reason the No. 8 25-cycle unit is not ready for operation, it is apparent that two units of the next size, 12,000-kw., must be used to carry the load. The load would preferably be divided equally between these two machines, and it will be noted that at 9,500-kw. load each machine would require 187,500 lb. (85,000 kg.) per hour. This means that the boiler room would have to supply 375,000 lb. (170,000 kg.) of steam instead of 256,000 lb. (116,000 kg.) as required for one 20,000-kw. unit.

In addition to the steam requirements of generators and auxiliaries, 15,000 lb. (6,800 kg.) is required for the fixed steam requirements of the station. The total steam requirements with two 20,000-kw. machines in

RATING OF LARGE MIDDLE WEST CENTRAL STATION

Unit No.	Voltage	Cycles	Date Built	Rating in Kw.
1	4,500	60	1911	10,000
2	4,500	60	1911	4,000
6	4,500	60	1910	12,000
7	4,500	60	1917	20,000
9	13,200	60	Not in service	20,000
Total rated capacity, 60-cycle machines				66,000
3	6,600	25	1910	12,000
4	6,600	25	1909	12,000
5	6,600	25	1911	12,000
8	6,600	25	Not in service	20,000
Total rated capacity, 25-cycle machines				56,000
Aggregate capacity, 60-cycle and 25-cycle				122,000

service, one supplying 19,000-kw., 25-cycle, and the other 18,000-kw., 60-cycle, would therefore amount to 250,000 lb. plus 245,000 lb. plus 15,000 lb., or 516,000 lb. (234,000 kg.). This information is transmitted to the boiler room a half hour before it is estimated that the load will be required, and from characteristic curves of the boilers the most efficient boiler combination is figured out in much the same manner as has been indicated for the generators. (See ELECTRICAL WORLD, June 26, 1920, page 1486.)

When machines now on order have been put in service the total rating of this station will be 122,000 kw., made up of the three-phase General Electric Company turbo-generators shown in the table.

The standard operating conditions in the boiler room of this plant are: Steam pressure, 210 lb. per sq. in. (14.7 kg. per sq. cm.), 130 deg. Fahr. (55 deg. C.) superheat; 28.5 in. (72.4 cm.) vacuum with 30-in. (76.2 cm.) barometer.

S. N. CLARK.

Chicago, Ill.

From 15 to 20 per Cent Reactance Desirable for Arc-Type Furnaces

TO LIMIT the voltage regulation on 13,200-volt lines of a Western company feeding arc-type furnaces, a reactance (including transformers) of 20 per cent has been found necessary with 200-volt arcs and of 15 per cent with 100-volt arcs.

This central station, which has many steel furnaces ranging from 1-ton (900-kg.) to 12-ton (10.8) capacity connected to its system, supplies all such loads from its 13,200-volt lines. The majority of the furnaces on the 25-cycle system are supplied through transformers designed with 12 per cent inherent reactance. However, 12 per cent reactance has been found low, and the most recent installation is equipped with a transformer having 20 per cent inherent reactance. The amount of reactance required is affected somewhat by the type of the furnace used. Those arc-type polyphase steel furnaces which operate with approximately 100 volts between electrodes do not produce surges on the line as great as those which result from the operation of furnaces with 200 or more volts between electrodes. The arc of lower voltage is better from the power company's standpoint, but the high voltage between electrodes seems to be much more desirable for the steel men because it permits of more rapid melting.

A 3-ton, three-phase arc type furnace having about 208 volts between electrodes was connected to the company's 60-cycle, 13,200-volt system through a transformer with 12 per cent inherent reactance. This reactance proved entirely inadequate, so external coils were added to bring the total reactance up to 20 per cent. Even then the regulation on the line is about 10 per cent.

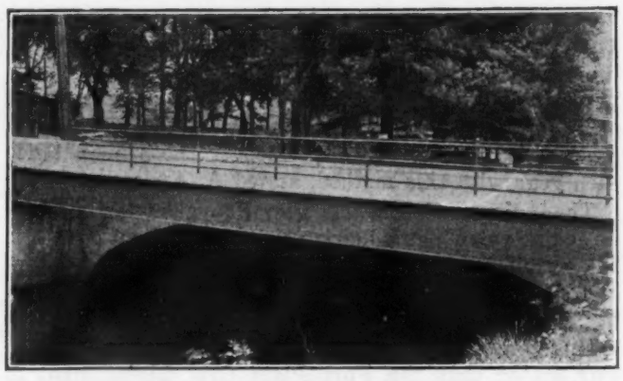
Furnaces of the same size but with approximately 100 volts between electrodes are being operated satisfactorily on 60-cycle, 13,200-volt lines when supplied through transformers having about 15 per cent inherent reactance.

This particular company has no steel furnaces connected to its 4,000-volt lines with the exception of a very small one which requires only a maximum demand of 100 kva. The furnace is supplied from a 250,000-circ.mil (126.7-sq.mm.) line which is essentially a power feeder. The disturbance caused by this furnace is no greater than that caused by certain welding loads connected to the 4,000-volt system. It has not resulted in any undue fluctuations in the line voltage.

Chicago. G. G. POTTS.

Attractive Construction for Supporting Cable Across Stream

THE attractive concrete-filled steel girder shown herewith is employed to carry power cables of the Worcester (Mass.) Electric Light Company from the Webster Street station across a small stream. This



REINFORCED CONCRETE BETWEEN BRIDGE GIRDERS CARRIES POWER CABLE ACROSS STREAM

support crosses the stream beside a highway bridge and was designed to harmonize with the bridge. It is supported at each end by concrete walls.

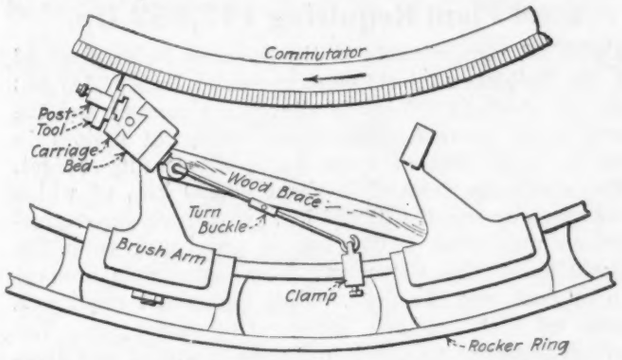
Boston, Mass. H. S. KNOWLES.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Turning a Commutator in Place

FOR turning down a commutator without removing the armature from its bearings the method described here has proved successful to the writer. The turning tool, as shown in the drawing, is simply a long tool carriage with lengthwise feed, which is mounted on a



METHOD OF MOUNTING TOOL TO TURN DOWN A COMMUTATOR IN PLACE

brush arm by two eyebolts and cap screws. The slide block has a screw-adjusted taper edge for making it fit tight in the slide and thus prevent chattering of the tool. On an engine-driven generator the tool is mounted on an arm near the bottom of the machine so the chips will fall away from the armature. If a bottom arm cannot be used, the top arm must be employed. Mounting on either side is bad because any shaft throw in the engine will cause the commutator to be not truly round. As there is no shaft throw in turbines or motor-generators, the tool can be mounted on a side arm if desired.

A fiber cardboard shield is hung so that chips cannot fly into the tails. A wooden brace is placed between the arm holding the tool and the next arm behind to take the pull of the turnbuckles. Slack is taken out of the rocker-ring adjusting screw and wedges of hard wood are placed between the ring and each top bracket to prevent any play.

The cutting tool must be of the best high-speed steel with a sharp diamond point and should slant toward the tails. The cutting speed on 500-volt or 250-volt machines with a good deal of mica should be from 200 ft. to 400 ft. (60 m. to 120 m.) per minute. Low-voltage machines with less mica can be cut at speeds up to 500 ft. (150 m.) per minute. Adjustment of the tool to take the next cut is made by hammering the butt end around, causing the cutting point to swing in toward the commutator.

Gas-engine generators can seldom be run slow enough to turn and usually must be ground. Sometimes they can be run slowly and steadily enough on the starting air. Motor-generator sets and turbine-driven machines cannot be run slow enough under their own power except under special conditions. Usually it is best to belt a motor to the machine to drive it at the proper speed for turning.

After turning, the tool marks are removed from the commutator by a grit stone or fine sandpaper, and it is burnished with a piece of oily canvas. Kerosene is undesirable as it penetrates the mica, dissolves the shellac and never dries entirely.

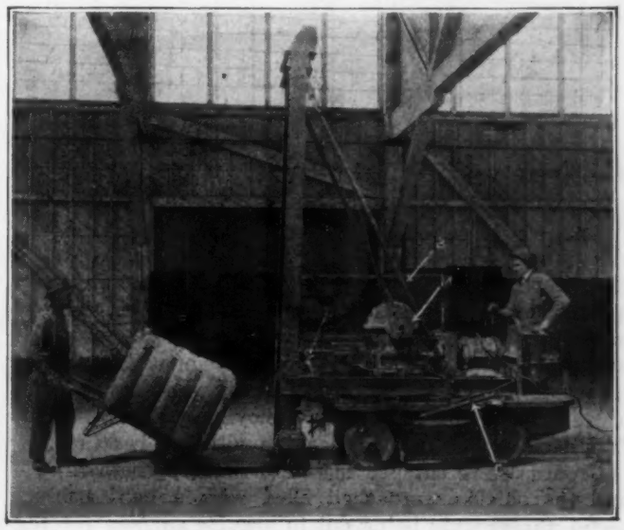
It is sometimes necessary to turn a machine while running it as a motor. In this case, before the tool is mounted, the arm is disconnected and insulated from the bus ring and the turnbuckle rods and braces are insulated. Full voltage is put on the field and an adjustable resistance is inserted in the armature circuit so the machine will run at a slow speed. In turning extra care must be observed to keep chips out of the armature. The tool will be alive and care must be used to avoid shorts. A fuse just large enough to carry the current should be put in the line so that if a short circuit occurs there will not be serious damage.

This method cannot be used on a machine which has undercut mica because the tool is certain to draw copper over the mica and short-circuit the bus.

Cleveland, Ohio. JAMES DIXON.

Stacking Elevator Mounted on Industrial Tractor

FOR stacking gunnybales at the port of Seattle two electrically operated stacking elevators have been built which when in use are mounted on standard electric industrial tractors. These elevators consist of a



MOTOR-DRIVEN ELEVATOR FOR STACKING BALES WHICH IS DETACHABLE FROM INDUSTRIAL TRACTOR

platform which is raised in channel-iron guides by means of cable wound by a motor on the tractor. This platform raises the 1,400-lb. to 2,000-lb. (560-kg. to 870-kg.) bales from the floor level to about twice the height of a bale.

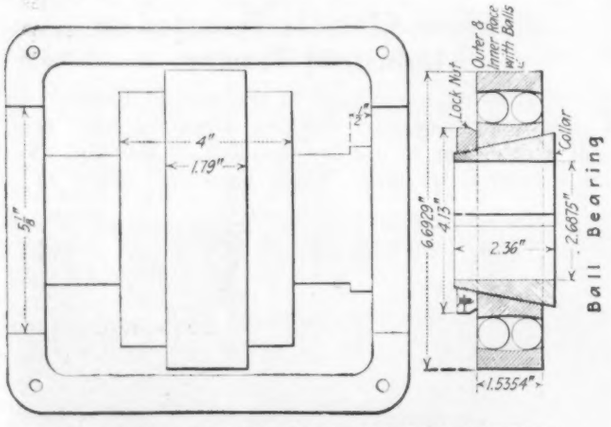
The channel-iron guides, as shown in the illustration, are mouted on wheels by which most of the weight of the lifted bales is supported. Diagonal braces *B* run from the guides to the horizontal channel members on which are mounted the motor *E*, the reduction gears and the drums *M* on which the cables are wound. To permit passage under low doorways the guides are pivoted at a point *L*, so that they may be laid backward after the rods *B* are unbolted. Two hoisting cables are employed to give a balanced pull on the gearing. For power an induction motor is used, fed through an extension cord connected to the nearest circuit. A direct-current motor supplied from the storage batteries of the truck might be used instead of this induction motor.

When it is desired to take the elevator off the truck, the steel attaching clamps are removed and the pivoted struts *C* are swung down, after which the truck is run out from under the elevator, which is left supported by the struts. In order to allow stacking in a narrow space, a pivoted table has been designed (not shown in photograph) which will permit the elevator to be swung around at right angles to the truck.

San Francisco, Cal. C. W. GEIGER.

Fitting Ball Bearings to a Sleeve-Bearing Machine

A METHOD of replacing worn sleeve bearings with ball bearings which was followed recently with an old alternator in an Eastern shop is described in the following paragraphs. The machine was a standard 50-kva., six-pole, 440-volt, 60-cycle, 1,200-r.p.m. alternator which had its bearings and shaft badly worn so



OLD SLEEVE BEARING CHANGED FOR BALL BEARINGS

that it was necessary to renew the bearings and take a light cut off the shaft. It was found that new sleeve bearings would have to be made up specially, which would require a long time, and as the machine was of a very old type their cost would be high and the problem of renewal would always be annoying. It was therefore decided to equip the machine with ball bearings.

Grooves were chipped in the oil wells of both shields and the shields were then filled with a hard babbitt metal, the grooves being cut to provide anchors for the babbitt metal. The shields were then turned out to dimensions as shown in the sketch. In turning the shield, ¼-in. (64-mm.) liners were put between the bearing cup and housing, which permitted just the right amount of metal to be turned out of the cap. Care had to be taken in machining the shields to have the work turn slowly in the lathe since the cap is of cast iron and the bearing seat of babbitt metal; otherwise when the tool strikes the cast-iron cap it would spring out of center.

The shaft was turned slightly smaller to remove its rough worn surface. The ball bearing used (type S.K.F. 1616) consists of three parts, namely, the outer and inner race with the balls, a split collar and a lock-nut. It will be noted that such bearings can be locked on any part of the shaft so that the end play can be adjusted to any amount desired. To complete the job the bearings were assembled on the shaft at the proper distance between centers and the whole machine was assembled. EUSTACE J. SOARES.

Ampere, N. J.

Motor Distribution and Consumption in Steel Plant Requiring 117,852 Hp.

POWER requirements at the Sparrow Point plant of the Bethlehem Steel Company reach a total of 117,852 hp., of which 64,000 hp. is alternating current and the rest direct current. The total number of motors in use is 2,169, 583 of these being alternating-current. The maximum demand is about 26,600 kw., of which the company supplies 12,000 kw. from three gas-engine-driven units and 14,000 kw. is purchased from the Consolidated Gas Company. Raw material is brought in by boat, and the ore-handling equipment requires a total of sixty motors, representing 3,618 hp. The average energy required to handle a ton of ore from steamer to stock pile and from there into the furnace stock bins is from 1½ kw.-hr. to 2 kw.-hr. The coal-handling plant for unloading and crushing requires a total of fifty-six motors, representing 4,100 hp. For the total coke-oven plant, including the coal unloading and crushing and by-product plant, there are a total of 474 motors, representing 8,035 hp. The power consumption of these motors per ton of coke averages 1.3 kw.-hr. It takes ninety-six motors totaling 10,087 hp. to handle the requirements of the blast-furnace department. Average power consumption per ton of pig iron, excluding casting plant and sintering plant, is 6.9 kw.-hr. There are 141 motors in the open-hearth department, totaling 7,947 hp., with an average power consumption in a No. 2 open hearth, with one furnace duplexing and two furnaces on cold charge, of 4.6 kw.-hr. per ton of ingots. Power requirements of the blooming billet and bar mill layout, including a roll shop, are taken care of by 181 motors, totaling 18,487 hp. The power consumption of the 24-in. (60-cm.) mill averages 9.55 kw.-hr. per ton of finished billets, while the 18-in. (45-cm.) mill consumes 26.8 kw.-hr. per ton of finished steel bar. In the 36-in. x 110-in. (90-cm. x 275-cm.) sheared-plate mill there are 122 motors, representing a connected load of 8,653 hp. Power consumption on the main motor averages 21.0 kw.-hr. per ton of slabs and for the entire mill 44 kw.-hr. per ton of slabs rolled. There are 126 motors in the 60-in. (150-cm.) plate mill, totaling 10,128 hp., and a 1,000-kw. motor-generator set. The entire tinplate plant, including coal-handling machinery, pumps, air compressors, etc., totals 5,441 hp. in 116 motors, of which twenty-one motors, totaling 590 hp., are on the cranes. The requirements of the sheet mill are met with twenty-six motors, totaling 6,070 hp.

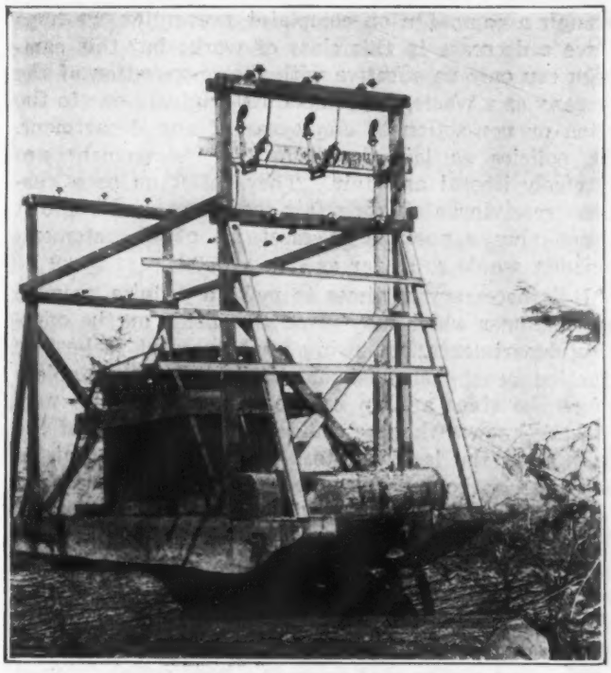
For supplying salt-water service all over the plant there is a central pumping station, consisting of three

30,000,000-gal. pumps driven by three 1,200-hp., three-phase, 25-cycle, 6,600-volt wound-rotor induction motors. The iron and gas foundry requires 136 motors, totaling 2,351 hp.

These facts were brought out in a paper by R. B. Gerhardt on "The Modern Steel Plant," presented before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers at the Feb. 7 meeting.

Portable Substation Mounted on Sled

IN ORDER to avoid repeatedly setting up a substation and tearing it down when operations moved from one locality to another, the complete substation was permanently mounted on a logging sled which is moved as the work of lumbering carried on by the Snoqualmie



MOUNTING TRANSFORMERS ON SLED SAVES LABOR AND TIME OF REPEATEDLY SETTING UP

Falls Lumber Company, Oregon, progresses from one place to the next.

In the use by this company of an electric yarding machine for lumbering it was found that the transportation of the transformer equipment from one setting to the next required considerable time and the efforts of at least four men for half a day. In the endeavor to better this record the transformers were mounted on the sled. This has done away with much of the trouble of hauling, and the reconnecting can now be handled by one lineman in about an hour.

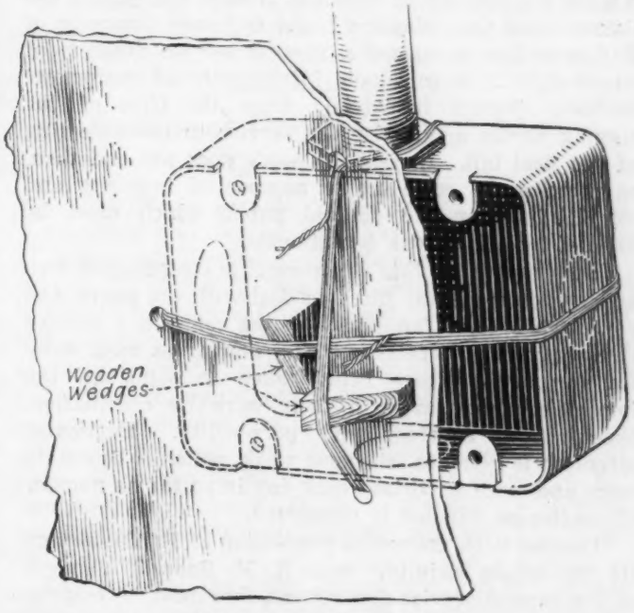
The transformer equipment consists of three 200-kva. single-phase transformers at the power house, which step the voltage up to 13,000 volts, and two 250-kva., three-phase transformers in the woods, which step the voltage down to 550 volts for operating the motor. These step-down transformers are set up about 300 ft. or 400 ft. (90 m. or 120 m.) from the spar tree and of course must be moved whenever operations are transferred to a new locality. This occurs about every twenty-five days, the distances varying from 1,000 ft. to a mile (300 m. to 1.6 km.).

The transformers were mounted on a sled, as shown in the illustration, a structure being built on the sled to support the incoming lines. The 13,000-volt transmission line terminates on cross-bars held by two poles at 8-ft. (2.5-m.) centers. A disconnecting switch is permanently mounted on this structure, making it possible to cut off the current at this point. The energy from the 550-volt side of the transformers is carried to the motor by means of a three-conductor armored submarine cable laid along the ground.

F. E. GRAY,
Electrical Engineer.
Snoqualmie Falls Lumber Company,
Oregon.

Setting Outlet Boxes in Reinforced Concrete Columns

IN ELECTRICAL WORLD of March 6, 1920, page 553, an article described a method of supporting conduit outlet boxes in steel forms before the reinforcing steel of the column has been located in position. The present writer uses another method for supporting the boxes in columns where there is a considerable amount of reinforced steel, as in 18-in. x 30-in. columns, which are used on all large concrete buildings. With columns of this size the reinforcing steel has to be placed before the steel forms are set up, and in this case the conduit with the outlet box attached is put in place before the forms for the concrete. To fasten the box to the form four holes are drilled in a sheet of the form so that one hole will be in each side of the box and about 1 in. (2.5 cm.) from the side of the box. After the box has been tightly filled with paper to prevent concrete from entering, four strands of wire are placed through one set of holes around the sides of the box and four strands are placed around the top and bottom of the box with two of these



OUTLET BOX TIED TO STEEL FORM

wires on each side of the pipe so as to hold the box straight and in place. The ends of the wire on the outside of the form are then twisted together and two small wooden wedges are driven between the wires and the steel form until the box is flush with the steel column.

Baldwin & Stewart, NICHOLAS F. CONDRON.
Meriden, Conn.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

New England Electric Truck Business Growing

ABOUT 200 industrial electric trucks were added to New England plant service during the last eighteen months and about 150 electric road trucks, according to figures recently given before the New England Section of the National Electric Light Association. It is estimated that there are now no less than 1,400 industrial electric trucks in operation in these six states and 1,200 road trucks of the electric type. Industrial plants are showing much initiative in this field, and the value of the charging load to the central station is coming to be better appreciated. Figuring an average revenue of 60 cents per day for truck battery charging shows a possible central-station revenue of about $500,000 a year from this source, supposing that energy were supplied for this work by the utility companies. The revenue from a small industrial electric truck may easily equal that of fifteen to twenty-five flatirons.

Baltimore Company's Service Department Aids Public Relations

RECOGNIZING that its success would be measured by the manner in which it treated the public, the Consolidated Gas, Electric Light & Power Company of Baltimore has organized a general service department whose duty it is to handle intelligently all customers' business (except industrial) from the time of the signing of the application for service to the collecting of the final bill. In fact, its work does not end then, as there are a considerable number of inquiries and complaints from the general public which must be handled by the various departments.

The personnel of this department is composed of men and women especially fitted to deal with the public and who have become familiar with the company's policies through years of training. New employees meet daily for instructions, care being taken to point out the important part played in their work by conciliation, cheerfulness, courtesy and personality. Particular attention is given to telephone work, which is becoming more and more important each day in so far as number of customers handled is concerned.

"Dealing with the entire population of Baltimore and its immediate vicinity," said R. F. Bonsall, manager of the general service department, "we must necessarily treat with many phases of human nature. We expect a number of what might be termed unreasonable requests, but each of these requests means a necessity or convenience to the particular customer and should be handled on its own individual basis. Conditions often arise over which the customer has no control and which are against the rules, but rules are made only for guidance and should, wherever necessary, be broken.

"On March 31 we had 67,000 electric and 144,000 gas customers, which means that if you average to each customer four persons, we are in contact, as far as service is concerned, with 700,000 people each twenty-four hours in the day. To take applications from, read meters of, bill and collect from such a number of persons satisfactorily is the aim of the general service department. This does not include complaints, because through a campaign on complaint prevention we hope to see a decrease in this class of work; but this campaign can only be effective with the co-operation of the company as a whole, for complaints originate due to the action or non-action of employees of any department. The policies as laid down by the management are extremely liberal and fair. They insist on each customer receiving absolutely fair treatment, and while it is not always possible to meet all of a customer's demands, we do so as far as it is possible.

"It is necessary at times to make a definite promise to a customer which may place a hardship on the operating departments, but owing to the present real-estate situation a customer must sometimes move into premises before the steps are up or the windows in. He may not have known when he could secure possession of the house until the last minute. It is not right that he should be without service because we have arranged our work for the day. This is also true in the matter of complaints on service, where sickness or inability to prepare meals makes immediate attention by us necessary. True, it costs money to make these extra calls, but it is much better to go to this additional expense than leave the customer without service.

"We must realize that there is a very selfish interest behind the operation of our general service department. We are in a growing city and expect to remain, but our business is largely dependent on our fairness to the public as well as customers, and through whole-hearted effort on the part of us all we can improve on the present good feeling which the public has toward us.

"The importance of this work was demonstrated several months ago by four local magazines which came out about the same time, each of which had a more or less unfavorable statement regarding individual public utilities. Only one mentioned our company, and its closing paragraph was that while we were rated higher than any other public utility in Baltimore, it could give us only 95 per cent, and if we wanted to know why it did not give us 100 per cent, we should communicate with the editor. This we did and received the reply that he had forgotten why he could not rate us at 100 per cent.

"This effort toward service has been reflected in our relations with the city and the Public Service Commission—in fact, during 1919 we had only one case come up for a hearing before the commission, and the decision was rendered in our favor."

Merchandising as a Public Policy Asset

CENTRAL stations should seek contact with the public, and more advantageous relations can be obtained by the sale of electrical appliances than is generally possible through the contract or complaint department, according to E. C. Deal, general manager of the Springfield (Mo.) Gas & Electric Company, in discussing the subject before the convention of Missouri Association of Public Utilities. Too often central-station men overlook the possibilities of promoting a favorable public policy in the operation of a merchandising department, said Mr. Deal. The company's salesroom should be one of the most attractive stores in the town and conveniently situated for the public. The sales force should be made up of individuals capable of meeting the public in a pleasant, impressive manner and able to convey the policies of the general manager. Unless the merchandising sales department meets these requirements it is not being operated to the greatest advantage.

Life and Health Insurance for Chicago Company Employees

COMMENCING July 1, 1920, employees of the Commonwealth Edison Company were entitled to sickness and disability insurance running for two years and death benefits of from 50 to 150 per cent or more of their annual salary by paying dues which in most cases will amount to 2 per cent or less of the employee's salary. This plan will be handled through the newly organized employees' mutual benefit association.

Sickness, disability and death benefits all increase with the years of membership in the association, and for all employees who join before Sept. 1 the years of service in the company will count as years of membership in the association. The first thirty-six weeks' disability averages from 40 per cent of the salary of the employee who has been with the company six months up to an average of 80 per cent of the salary of the employee who has been with the company twelve years or more. For the next sixteen weeks the range of pay is from 20 per cent to 40 per cent of the salary, while the length of service ranges from a half year to sixteen years or more. These payments are for the first year's sickness or disability, and during the second year the employees receive an average of from 10 to 20 per cent of their salary. The six months' employees receive the lower figure, which is increased with the years of service, and the 20 per cent is given when the employee has been with the company twenty-nine years. These benefits are all for the monthly employees. Those who are paid at an hourly rate receive 75 per cent of these benefits.

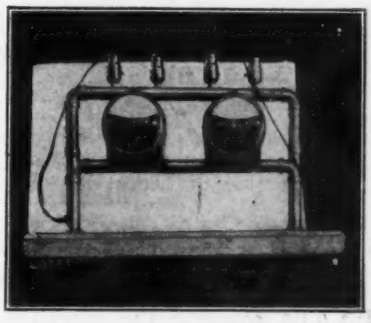
The death benefits, which are based on a maximum salary of $3,000 a year, vary from 50 per cent of the yearly salary for employees of six months' service up to 150 per cent of the yearly salary for employees who have been with the company for fifteen years. For every year in excess of fifteen that an employee is with the company the death benefits of 150 per cent are increased by 1 per cent.

The company pays all the overhead and operating expense for the association and approximately one-half of the benefits. Dues average $1.30 per month per $100 salary for employees of from twenty-four to thirty-four years of age. This increases every five years until the employee is from 65 to 69 years old, when he pays $7.26 per month. Dues increase as salaries increase.

Employees receiving a salary of more than $250 a month are not eligible for sickness and disability benefits. Such employees can join as associate members and have a reduction of 69 per cent in their dues in consequence. It is estimated that for every dollar paid in by the employees 69 cents will go for sickness and disability benefits and 31 cents for death benefits. The benefits of the association commence after one week's sickness or absence for disability, and for this week the company pays monthly employees their full salary.

Portable Meter Rack for Appliance Tests

INSTEAD of depending upon a fixed meter rack for showing the energy consumption of appliances to customers and visitors, the Lynn (Mass.) Gas & Electric Company has fitted up a portable rack, illustrated herewith, which is unusually attractive through the use of a marble base and polished brass framing to carry the wiring leads and instruments. Two meters are mounted on 1-in. (2.5-cm.) brass tubing, at the top of which are four pull-chain sockets to which various appliances are connected in demonstration. The uprights are 27 in. (69 cm.) apart on centers and 13 in. (32 cm.) high over all, the marble base being 10 in. x 28 in. x 2 in. (25 cm. x 70 cm. x 5 cm.) thick.



PORTABLE METER RACK FOR APPLIANCE TESTS

Outline of Day & Zimmerman's Cadet Course

IN ORDER to provide young men qualified to fill executive positions on their various properties, Day & Zimmerman decided in 1919 to inaugurate a "cadet" course. It is open to employees with proper qualifications and to engineering students in their freshman and sophomore years. The primary object is to develop executives, not specialists, and each cadet is being taken through a course of actual work in all departments.

This training not only determines a man's mettle and gives the thorough familiarity with all phases of the work which should be possessed by an executive, but also develops in him the ability to co-operate with other executives and with men who may eventually be under his direction.

The men for the cadet course who are not already employees of one of the properties are carefully selected from various colleges, the requirement being that they be freshmen or sophomores in electrical or mechanical engineering. The cadets selected from college are required to work three months each summer during the college course and complete the thirty-six months' work on full time after graduation from college. Cadets selected from among the employees work on full time and complete the course in three years. The course is

not one of technique, but one of practical application of technical training, and is arranged as follows:

Three months in the power house as an oiler.
Three months in the service department.
Three months in the boiler room as a fireman.
Three months in the meter department—test and installation of meters and instruments.
Three months as a patrolman.
Three months as substation attendant.

At this point the cadet selects either the production section or the transmission and distribution section. The decision is delayed until this time to permit him to make a wise selection.

PRODUCTION SECTION

Three months—Switchboard and power-plant attendant.
Three months—Load dispatcher.
Three months—Maintenance crew.

TRANSMISSION AND DISTRIBUTION SECTION

Three months—Construction and maintenance.
Three months—Load dispatcher.
Three months—Engineering department.

Then cadets in both sections take:

NEW BUSINESS

Three months—Power.
Two months—Light.

COMMERCIAL

Two months—Supply department.
Two months—Statistical department, analysis of reports.

Results of Twelve Months' Operation of Electric Ranges

DATA covering the operation of nineteen electric ranges for a period of twelve months have been received from a New England central station. This company's rate for domestic heating and cooking purposes is based on a demand charge of $2 per month for installations up to 5 kw., $3 per month for from 5 kw. to 7 kw. and $1 additional for each kilowatt of demand over 7 kw. plus a charge of 1.5 cents per kilowatt-hour consumed.

The accompanying table shows, first, the connected load of each range; second, the total amount of energy used during the entire year; third, average monthly consumption; fourth, total amount of bills for twelve months; fifth, average monthly bill; sixth, rate per kilowatt-hour. It will be noted that the average amount of energy used per month was 236 kw.-hr. at an average rate of 2.5 cents.

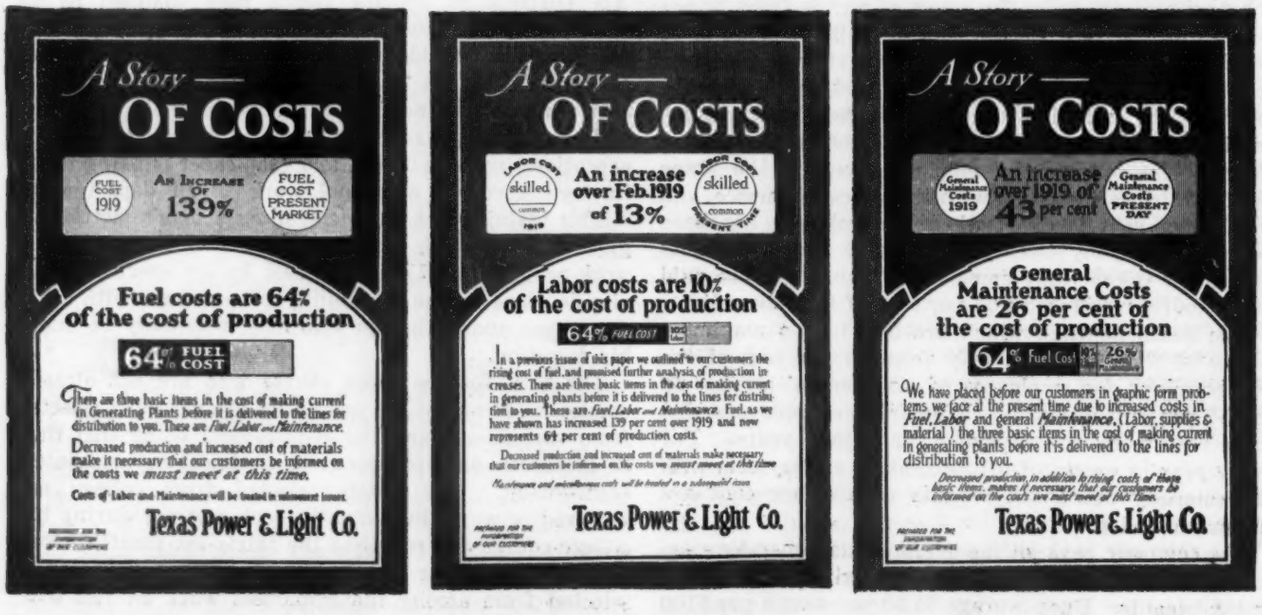
TWELVE MONTHS' OPERATION OF ELECTRIC RANGES

Maximum Demand, Kw.	Kw.-Hr. Used During Year	Average Monthly Consumption, Kw.-Hr.	Total Amount of Bills	Average Monthly Bill	Average Rate per Kw.-Hr.
6	3,504	292	$88.58	$7.38	$0.025
5	1,123	93	40.86	3.41	.036
7	4,299	358	100.49	8.37	.023
7	5,067	422	112.00	9.33	.022
6	2,930	244	79.95	6.66	.028
7	1,069	89	52.04	4.33	.947
7	2,280	190	69.13	5.76	.030
7	1,972	147	65.59	5.46	.037
10	3,908	325	109.65	9.13	.028
7	9,615	801	180.25	15.02	.018
6	616	51	45.25	3.77	.070
3	2,340	195	59.11	4.93	.025
7	4,427	369	102.42	8.54	.023
7	2,818	235	86.68	7.22	.031
7	1,954	171	68.32	5.69	.033
7	2,087	174	67.33	5.61	.030
5	582	48	33.19	2.77	.058
7	937	78	50.06	4.12	.053
6	2,268	189	70.03	5.83	.030
Total and average: 124	53,796	236	$1,480.93	$5.96	$0.025

Texas Utility Conducts Successful Publicity Campaign

TO INFORM the public of the necessity for increases in its light and power rates the Texas Power & Light Company, with headquarters at Dallas, is conducting a successful publicity campaign through newspaper advertising in the thirty cities and towns where it operates. In a series of three advertisements shown herewith the increases in the cost of producing energy are explained. The basic item of each advertisement is a production block which was completed by three steps showing percentages of fuel, labor and maintenance costs and their respective increased costs.

The campaign is being handled through the publicity office of the company at Dallas and the advertising has received much favorable comment from the public and the daily newspapers.


A Story —
OF COSTS
FUEL COST 1919
An Increase of 139%
FUEL COST PRESENT MARKET
Fuel costs are 64% of the cost of production
64% FUEL COST
There are three basic items in the cost of making current in Generating Plants before it is delivered to the lines for distribution to you. These are Fuel, Labor and Maintenance.
Decreased production and increased cost of materials make it necessary that our customers be informed on the costs we must meet at this time.
Costs of Labor and Maintenance will be treated in subsequent issues.
Texas Power & Light Co.
A Story —
OF COSTS
LABOR COST 1919 skilled
An increase over Feb. 1919 of 13%
LABOR COST PRESENT TIME skilled common
Labor costs are 10% of the cost of production
64% FUEL COST
In a previous issue of this paper we outlined to our customers the rising cost of fuel, and promised further analysis of production increases. There are three basic items in the cost of making current in generating plants before it is delivered to the lines for distribution to you. These are Fuel, Labor and Maintenance. Fuel, as we have shown has increased 139 per cent over 1919 and now represents 64 per cent of production costs.
Decreased production and increased cost of materials make necessary that our customers be informed on the costs we must meet at this time
Maintenance and miscellaneous costs will be treated in a subsequent issue
Texas Power & Light Co.
A Story —
OF COSTS
General Maintenance Costs 1919
An increase over 1919 of 43 per cent
General Maintenance Costs PRESENT DAY
General Maintenance Costs are 26 per cent of the cost of production
64% Fuel Cost
26% General Maintenance
We have placed before our customers in graphic form problems we face at the present time due to increased costs in Fuel, Labor and general Maintenance, (Labor, supplies & material) the three basic items in the cost of making current in generating plants before it is delivered to the lines for distribution to you.
Decreased production, in addition to rising costs of these basic items, makes it necessary that our customers be informed on the costs we must meet at this time.
Texas Power & Light Co.

TYPE OF PUBLICITY ADVERTISING BY THE TEXAS POWER & LIGHT COMPANY

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Coil-End Leakage Resistance.—L. DREYFUS.—The author attempts, in some introductory notes, to show how the magnetic lines of force will distribute themselves around those parts of the coils in an electric machine which are not directly surrounded by iron. Mathematical expressions are then derived for the fluxes around one single coil end, under certain simplifying conditions, due regard, however, being had to the effect of the neighboring iron surfaces in distorting the field. An actual example is considered in detail, the results of computations on the basis of the author's theory being compared to the values of leakage reactance for the same case as computed by means of the Arnold-Sumec and the Kloss methods. The author explains the deviations and states his reasons for assuming that the new formulas will give a more accurate result. He then takes up the problem of determining the interlinkages between adjacent coil ends of one phase and also between coil ends belonging to different phases in a polyphase machine. Numerical examples are worked out in detail in order to show the physical significance of each step in the theoretical evolutions.—*Elektrotechnische Zeitschrift*, Feb. 5 and 12, 1920.

Core and Incremental Losses in Rotating Machinery.—LAURENCE H. A. CARR.—The consideration of core-loss curves of 300 or 400 different machines has led the author to conclude that it is possible to lay down a general type of equation and to state the approximate values of the numerical constants for different cases, together with the effect of the various disturbing factors on the magnitude of the losses. He then proposes relations covering core losses and load losses which increase load.—London *Electrician*, May 21, 1920.

Lamps and Lighting

Coefficients of Utilization.—WARD HARRISON and EARL A. ANDERSON.—A method is presented for the direct determination of coefficients of utilization applying to installations of all ordinary types of lighting units in rooms of varied proportions and different ceiling and wall colors. As a basis for the method, coefficient of utilization data are tabulated from a series of several hundred illumination tests made in an experimental room with reflectors having three fundamental forms of light distribution. Illustrating the application of the data presented, typical coefficient of utilization tables, as determined for a number of reflector types in common use, are included.—*Transactions I. E. S.*, March 20, 1920.

Effect of Color of Walls and Ceilings on Resultant Illumination.—A. L. POWELL.—An abstract under this heading appears on page 1206 of the issue of May 22. The credit was erroneously given to the *Transactions I. E. S.* It should have been given to the *General Electric Review* for March, 1920.

Developments in Street-Lighting Units.—A. D. CAMERON and C. A. B. HALVORSON.—The writers draw attention to the growing tendency to use lamps giving intensities which are totally insufficient for street lighting. This is due to the desire of municipalities to keep down their street-lighting expense. At the same time lamps are being neglected, there being insufficient renewals, and dust is permitted to accumulate to such an extent that it seriously reduces the light flux and ruins the appearance of the installation.—*Transactions I. E. S.*, April 30, 1920.

Generation, Transmission and Distribution

Pulverized Coal.—The writer states that early attempts to use pulverized coal in England were not very promising, but that experience in America has now proved that the method may be used successfully. He deals with the changes necessary in water-tube boilers for the application of powdered fuel, indicating that the front of a furnace may be extended and converted into a combustion chamber. The required space for combustion is decided by the maximum demand likely to be made on the boiler and a ratio of 40 cu.ft. per lb. (0.5 cu.m. per kg.) of coal burned per minute is said to be a fairly safe minimum combustion space for large stationary boilers.—*Electrical Times*, May 20, 1920.

The Protection of Alternating-Current Circuits and Apparatus.—E. T. NORRIS.—A comprehensive discussion of the theory of protective systems, including reverse power relays, Merz-Price, split conductor, protective sheath and other systems.—*Beama*, May and June, 1920.

Oil-Burning as an Industrial Proposition.—F. SCHOUMANNE.—The coal shortage in Europe, which shows decided tendencies toward permanency, has emphasized the necessity of giving a careful study to the economical possibilities of naphtha and low-grade oil as industrial fuels. After some introductory remarks regarding the fuel value of Russian oils, the author describes a number of different oil burners, giving particular attention to those devices which are most commonly used for oil-burning plants in the Baku region. The article ends with a discussion of the relative advantages of the more important oil-burning systems.—*Revue Générale d'Electricité*, April 10 and 17, 1920.

Traction

Electrification of the Swedish Railroad System.—The Swedish government, which owns and operates the greater part of the railroads of Sweden, is planning an immediate electrification of certain trunk lines, first of all the important cross-country road from Stockholm to Gothenburg. Very good results have already been obtained with single-phase, 15-cycle supply in the remarkable Kiruna-Riksgränsen electrification in the north of Sweden, and much attention therefore has been given this system of supply, the recent large direct-cur-

rent electrifications in America having emphasized its possibilities and economy. A most comprehensive comparative study therefore has been made of both these systems, although no definite conclusions were reached, since the estimated yearly cost came out very nearly equal for both systems. However, the single-phase system seems to have been most favorably reported. Several technical reports on the question, submitted by the various administrative and engineering bureaus, were reprinted in the *Teknisk Tidskrift, Elektroteknik*, March 3, April 7 and May 5, 1920.

Installations, Systems and Appliances

The Electric Propulsion of Ships.—ESKIL BERG.—The writer outlines some of the advantages of electric drive for ships as evidenced by the experience already obtained on ships of the United States Navy. From the point of view of economy he also points to the possibility of electrical drive for merchant vessels.—*Journal Engineers' Club of Philadelphia*, May, 1920.

Electric Purification of Air.—D'ARSONVAL, BORDAS and TOUPLAIN.—The authors have experimented with a simple apparatus consisting of a brass tube 1 m. long with an axial wire, air being passed through the tube at the rate of 127 cu.m. (4,500 cu.ft.) an hour. The air was purposely polluted with a fine sterile mineral powder and also with dried cultures of a certain microbe. After passing through the tube, the central wire being maintained at a negative potential of 50,000 volts, the air was found to be absolutely sterile, while 95 to 97 per cent of the powder was removed. Before passing the tube samples of air gave 150 cultures of the microbe per cubic meter. It is suggested that the ozonization may have aided in destroying the microbes. —*Comptes Rendus*, March 15, 1920, reprinted in *Revue Générale d'Electricité*, April 10, 1920.

Telegraphy, Telephony and Signals

Method for Measuring the Received Current in a Radio Antenna.—H. DE BELLESCIZE.—The extreme smallness of the electromotive forces induced in a receiving antenna makes it impossible to measure the amplitude of the received current directly. The author instead suggests an indirect method, based upon a comparison, by means of telephones and, if necessary, amplifiers, of the intensity of sound obtained when receiving from a given distant station with the intensity when the receiving antenna is excited from a small auxiliary transmitter adjusted by heterodyning to exactly the same wave length as the transmitting station. The auxiliary oscillator is coupled to the antenna by means of a variable coupling coil of known constants. The transmitting station must be controlled by a chronograph so that it transmits during alternate periods of, say, ten seconds, the auxiliary oscillator being similarly controlled to excite the receiving antenna during the silent ten-second intervals. The auxiliary oscillator coupling and oscillation amplitude are adjusted till an unbroken sound of constant strength is heard in the telephones. The electromotive force induced by the incoming waves then is just equal to the electromotive force induced in the coupling coil, which may be determined from the oscillator calibration.—*Revue Générale d'Electricité*, March 6, 1920.

Submarine Signaling.—During the war mechanisms and systems were developed not only for communicating between two ships similarly equipped and between a ship and a power station by means of under-water signals, but also for sending messages to and from a separate submarine. The suitability of the Fessenden oscillator and other devices used in submarine service is discussed.—London *Engineer*, May 14, 1920.

Electric Transmission of Danger Signals to Moving Locomotives.—Several more or less successive systems have come into use for automatic repetition of semaphore signals on moving locomotives. In an interesting system suggested by Angereau and now being tested by the French state railroads a wireless transmission is used, although of somewhat primitive nature. Along the track is an antenna, excited by induction coil and spark gap, and the engine is provided with a similar little antenna, connected to a coherer. Track contacts close the transmitting circuit when the train passes the signal, and if the semaphore is in danger position, Herzian waves are sent out, which upon being received act on the coherer and by means of relays start the engine steam whistle blowing.—*Revue Générale d'Electricité*, April 10, 1920.

Miscellaneous

Use of Electric Surplus Power for Heating Purposes. —H. THEORELL.—Particularly in case of water-power stations with adequate hydraulic reservoirs it is a direct waste of power ever to let the load go down below its maximum value. Off-peak power then may be very economically utilized for heating purposes, not only for electrothermal processes, but for plain heating of industrial and other localities. An electric heating plant of remarkable size has been in operation since 1914 at the Husquarna factories in Sweden. The factories obtain electric power from a hydraulic station, which, owing to topographical conditions, is practically void of all water-storage facilities. During all the night, therefore, the power (maximum 1,300 kw.) is used to heat the water in a large subterranean tank of 200 cu.m. (44,000-gal.) capacity, the water being circulated during daytime in the heating system of the factory. On a twelve-hour day basis the surplus power is sufficient for the heating of all the shops, except when the outside temperature is lower than 5 deg. C. (13 deg. Fahr.). In very cold weather it becomes necessary to use part of the original coal firing plant, which has been maintained in a stand-by capacity. The electric heating plant has utilized about 2,000,000 kw.-hr. a year, corresponding to a direct saving of about 400 tons of coke a year, while the first cost was only 24,000 kronen (about $6,000). The author also describes at length an electric hot-water plant of remarkable dimensions which is being planned for the Norwegian city of Bergen.—*Teknish Tidskrift, Mekanik*, April 14, 1920.

Porosity and Volume Changes of Clay Firebricks at Furnace Temperatures.—GEORGE A. LOOMIS.—This investigation is a study of some of the physical properties of clay firebricks by a comparison of their changes in porosity and volume, on heating to different temperatures, with the amount of contraction of the bricks under load at furnace temperatures and with the so-called "melting points" of the bricks. It is found that the porosity and volume changes serve as an indication of the ability of a clay firebrick to resist deformation under load at furnace temperatures much more reliable than the "melting point." It is also shown that these porosity and volume changes serve in explaining the failure of firebricks in use from such causes as insufficient burning in manufacture.—*Technical Paper No. 159, U. S. Bureau of Standards*, April 26, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department, "Digest of Electrical Literature," for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CABLE DIELECTRICS, APPROPRIATION FOR

Authority was granted to the Technical Section of the N. E. L. A. to take up research and investigation on cable dielectrics, an initial appropriation of $3,000 being made for the purpose.

LAMP, CADMIUM VAPOR ARC.

A successful cadmium-vapor lamp is a stable source of monochromatic red light of high intensity. But when pure cadmium is distilled into the quartz lamp and freezes, the metal adheres to the silica with such tenacity as either to crack the lamp or to peel strips of the silica from the walls. It was discovered that the metal gallium is readily alloyed with cadmium, and that a very small quantity, less than 1 per cent, is sufficient to change radically the character of the cadmium and greatly to reduce its tensile strength. All breakage of the lamp was eliminated. In using this alloy in a quartz-vapor lamp, the cadmium spectrum is obtained of great brilliancy and purity. The spectrum of gallium is practically absent. A lamp of this type, using lead seals to render the electrodes proof against leakage, can be operated continuously with no variation in the high intensity of the cadmium lines, and appears to have an indefinite life.—*Frederick Bates, Bureau of Standards, Washington, D. C.*

PORCELAIN, SOLUBILITY OF, IN WATER.

Some interesting developments have recently been brought out by the use of very high pressures on the solubility of porcelain in water under certain conditions, and it is probable that considerable light will soon be thrown upon certain types of insulator depreciation as a result of these developments.—*W. D. A. Peaslee, Huntington, W. Va.*

RADIO, RESONANCE WAVE COIL.

A resonance wave coil has been developed. The coil is in the form of a long helix wound with a large number of turns on which stationary waves are produced by the incoming radio signals. An electron tube is used as the detector, the grid being connected to the point of maximum potential on the coil. The wave coil may be used either as a part of the usual antenna system or a part of a line wire, or it may act itself as the antenna for picking up the energy of the signals. In the latter case the coil may be either free at both ends or grounded at one end. Good results have been obtained in either case. It has been also found that the open coil has directional properties and can be used as a goniometer not only for horizontal measurements but for vertical measurements as well. This form of radio goniometer has the great advantage that it permits the determination not only of the plane where the signals are strongest but also of the direction from which such signals proceed.—*G. O. Squier, War Department, Washington, D. C.*

VACUUM TUBE GENERATOR, OUTPUT CHARACTERISTICS OF.

An extensive theoretical and experimental investigation of the three-electrode vacuum tube used for generating oscillations has been made and fundamental formulas have been established for power output, grid voltage and efficiency. It is shown that the principal constituents of the electron currents which will be supplied by a given tube under action of sinusoidal plate and grid voltages can be computed as functions of these voltages from a group of "static characteristics" of the tube which are obtained by varying these voltages step by step and measuring the resulting steady values of current.—*L. M. Hull, Bureau of Standards, Washington, D. C.*

WAVES, ELECTROMAGNETIC, VARIATION IN DIRECTION OF.

The observed direction of radio waves as obtained with a direction finder varies with time when long waves are used as those from very high power stations. The variations of direction are of the order of 90 deg. for very long waves. No such long variations are found for short damped waves produced by spark apparatus. A method of increasing the sharpness or determination of direction has been worked out. A theoretical explanation of the variations of directions has been found, based on the existence of media in the earth's atmosphere capable of reflecting and refracting the waves.—*A. H. Taylor, U. S. Naval Aircraft Laboratory, Washington, D. C.*

Suggestions for Research

DUCTS, METALLIC, FOR CABLES.

An increase in the current-carrying capacity of under-ground cables is one of the most important questions that confront the electrical industry. The problem becomes more and more difficult as cables are being made for higher and higher voltages, necessitating thicker insulation. A method which has been attempted in various ways is to keep down the temperature of the ducts themselves. A suggestion comes from a cable specialist to try metal conduits, so as to reduce the temperature gradient between them and the ground. Cast-iron pipes have remained intact in the ground for many years, and with proper precautions rusting may be minimized. He further suggests that in such metal conduits all the ducts be kept in one or two rows only, so as to avoid hot inner ducts. Preliminary experiments are desired and an estimate of the increase in the cost of the conduits as against a saving in the cables themselves.—*Editorial Suggestion.*

FURNACE, ELECTRIC, FOR BRASS.

While the electric furnace for melting steel has reached a considerable degree of perfection, electric brass furnaces are said to be much less satisfactory and are much less used. At the same time, there is a great demand for such furnaces throughout the country, especially in sizes of between 500 lb. and 1,000 lb. (225 kg. to 450 kg.) for small brass foundries. The greater expense of operation of an electric brass furnace as compared to the ordinary pot charge, molten on coke fire, is not important when the other advantages of electric melting are considered. Additional research is required to develop the details of construction, temperature regulation, tilting, etc., and to standardize the most important parts in order that brass foundries may confidently expect satisfactory results without experimenting. The molten brass has to be continually stirred to prevent its separation into component metals, and this is done by shaking or turning the container by an electric motor. Some simplification in this operation is also desirable.

FUSE, RENEWABLE, INDICATOR FOR.

Many non-renewable inclosed fuses of cartridge type are provided with an indicator, which enables one to distinguish a blownout fuse from the outside. To provide such an indicator for a renewable fuse is a more difficult matter, because presumably the indicator would have to be renewed every time with the fusible link. The problem is well worth a solution, because the addition of an indicator would make renewable fuses much more desirable.—*Editorial Suggestion.*

LUBRICANT FOR HEAVY PRESSURES AND HIGH SPEEDS.

Difficulty has been experienced in the operation of bearings capable of withstanding the stresses brought into play by heavy masses revolving at from 10,000 to 20,000 r.p.m. The problem is probably not so much one of the actual bearing design as it is of obtaining a lubricant with sufficient viscosity to withstand the temperature changes of these speeds and masses. A method is desired for measuring the viscosity and temperature variations of a lubricant while it is a contact film on the bearing. A determination of these variations in the character of the lubricant would enable considerable progress to be made in the design of heavy high-speed rotating machinery.—*K. H. Stark, New York City.*

MACHINERY, ELECTRICAL, HEATING ON ONE-HALF-HOUR RUNS.

I find that on one-half-hour runs the heating of electric motors of moderate size varies somewhat as the volume of copper and iron, divided by the watts lost. This does not take care of hot spots, and some other places of similar nature, but when the motor is inclosed it gives a general average near the teeth and windings. Further experiments and tests of this nature are desired.—*A. M. Holcomb, Clveland, Ohio.*

METER, PREPAYMENT.

The ordinary watt-hour meter is too expensive for the small customer, requires monthly readings, billing, collection, calibration, etc. The prepayment meter of the present type is also expensive and requires a periodic collection of the coins. A simple and reliable prepayment meter is desired of the "consumed" type, that is, one that is consumed by the passage of electric energy through it. In the case of direct current it may be a sealed electrolytic plug the contents of which are consumed in proportion to the number of ampere-hours passing through it. After it has been used up the circuit is interrupted and a new plug has to be inserted. For alternating-current circuits such a plug may be based on a thermal principle, involving, say, a compound to be melted by the current. Such prepayment cartridges could be sold in drug stores and elsewhere, so that the electric operating companies would have to undergo no expense for collecting from individual consumers. The device must be so designed that no unauthorized plug could be used as a substitute.

PERMEAMETERS AT HIGH PERMEABILITIES.

For some years the Burrows permeameter has been the standard instrument in this country for measuring the permeability of bar and sheet samples of magnetic materials. It has been found that for samples having maximum permeabilities of from 10,000 to 40,000 this instrument is often subject to appreciable errors, especially in the determination of hysteresis loops. A study of this apparatus when used with this material of high permeability would be of value. Recently the Fahy permeameter has received considerable attention. For certain magnetic samples it has been found that this instrument gives values of H at moderate inductions which are more than 100 per cent greater than those obtained by the Burrows permeameter on the same samples. A critical study of the limits of this instrument would be of value.—*T. Spooner, East Pittsburgh, Pa.* [With new grades of iron, obtained by melting it in vacuo, such high values of permeability have been obtained that a more accurate measuring instrument becomes essential. —*Editor's Note.*]

TELEPHONE, AUTOMATIC, WIPER CONTACT.

The wiper contact, its resistance and mechanical wear in various conditions, offers an interesting subject for study. The investigator should first become thoroughly familiar with the structure of the wipers and banks of automatic switches and the customary maintenance of them.—*A. B. Smith, Chicago, Ill.*

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

TRADE slackness due to the summer season is affecting the electrical industry, with jobbers reporting lighter sales. The freight situation, however, is improving except in the Puget Sound district, where the lumber industry is suffering from a 50 per cent shortage in cars.

LABOR is reported in good supply East and South, with a stronger demand on the Pacific Coast. Building in the Middle West is still slack, but in other parts of the country it is proceeding in good volume, especially as regards large industrial projects. Collections are tightening in some sections, particularly in Southern and New England districts, but money on the Pacific Coast is reported plentiful.

AN APPEAL has been filed by the Independent Lamp & Wire Company against the decision of the federal court in New Jersey in the Coolidge lamp patent case sustaining the General Electric Company.

POWER cable orders are in good quantity and shipments are lengthening. A marked tendency toward standardization is noted. Transmission towers are in better demand for export than for domestic use, especially those of large dimensions. Buying prevails in the Far East, Australia, South America and Canada.

INDICATIONS are that the fan season will not come up to early anticipations. Lack of transportation facilities rather than lack of orders is given as the reason, together with low seasonal temperatures and delayed hot spells. Fans are in fair assortment in the New York district; buying by distributers is about over in Boston; stocks are in pretty good shape in the Middle West, depleted in the South and plentiful on the Pacific Coast.

DESPITE the talk of prices having passed their highest point, motor manufacturers are inclined to anticipate a further increase in the cost of their product. The need of standardization in fractional-horsepower motors is demanding recognition, and manufacturers are working in that direction.

SALES of flatirons and other heating devices are reported to be heavy in all sections of the country, and the trend of prices is upward.

FIGURES issued by the Geological Survey show that New York State leads the nation in hydro-electric output, its monthly total for April being 268,736,000 kw.-hr. California comes next, with 219,475,000 kw.-hr. The total electrical output of the nation for the first four months of the year, including both water-power and steam plants, is put at nearly 15,000,000,000 kw.-hr. This includes central stations, electric railways and some other plants.

AN INCREASE of 5 mills a kilowatt-hour in power rates and of 1 cent in lighting rates has been granted to the Indianapolis Light & Heat Company and the Merchants' Light & Heat Company by the Public Service Commission of Indiana.

AN INVESTIGATION into lead-covered-cable failures in St. Louis is being made by the Bureau of Standards.

CONSTRUCTION of a super-powered radio station on the north shore of Long Island near New York City by the Radio Corporation of America is about to begin. Five units will afford simultaneous operation with as many foreign nations from 420-ft. towers.

SUCCESSFUL telephone communication has been conducted over live high-tension lines by the American Gas & Electric Company, which looks for far-reaching results in the direction of cheaper telephony to be achieved through this means.

FORMATION of the projected North Jersey Power Company with capital of $25,000,000, to be supplied in part by prospective consumers, has been postponed.

A MILLION-DOLLAR power line is to be built around the city of Toledo, Ohio, by the Toledo Railways & Light Company.

ARGUING before the Interstate Commerce Commission for the assignment at the mines of cars for public utility use, J. W. Lieb, representing the N. E. L. A., painted a grave picture of the fuel situation as it affects public service companies.

AN ORDER continuing permission of the use of open-top cars for coal transportation and providing for priorities for public utilities was issued on Tuesday by the Interstate Commerce Commission. This order, it is thought, will solve the difficulties of the utilities temporarily, but will need liberal interpretation to allow them to provide for winter contingencies. No fuel administrator will be appointed by the President at this time.

THE FIRST meeting of the new executive committee of the N. E. L. A. was held this week in New York. President Insull has appointed the chairmen of the national committees, subject to their acceptance.

A REHEARING has been asked by the Idaho Power Company in the matter of its petition to the Public Service Commission of the state for an increase of 60 per cent in its irrigation rates, only 10 per cent having been allowed.

ORGANIZATION of the new Public Relations Section of the N. E. L. A. has been deferred to Aug. 1.

LIEUT.-COL. WILLIAM KELLY has been appointed engineer officer of the Federal Power Commission. Final organization of the body awaits the return to Washington of Secretary of Agriculture Meredith.

PROGRESS in the organization of a co-operative electrical campaign for the Pacific Northwestern States was expected to be made at a committee meeting on Thursday and Friday.

PUBLIC co-operation was advocated and unfair taxation decried at the annual meeting of the Ohio Electric Light Association at Cedar Point this week.

ON CERTAIN interconnected systems in the East much improvement in joint frequency regulation is resulting from longer experience with interoperation.

THE MINIMUM charge for both gas and electric meter service will shortly be investigated by the Massachusetts Department of Public Utilities in response to a legislative order.

A STRONG program is being made up for the fall convention of the New England Section, N. E. L. A., at Kineo, Me., Sept. 14-17.

SINCE last fall more than $900,000 in securities of the Central Maine Power Company have been placed in the territory of the company, which, if pending petitions are granted, will soon serve 106 municipalities.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Federal Power Commission Organization Awaits Return of Secretary Meredith

LIEUT.-COL. WILLIAM KELLY has been appointed engineer officer of the Federal Power Commission. He is at present stationed in San Francisco, serving on river and harbor work.

The return of Secretary of Agriculture Meredith to Washington has been delayed, and as a result the organization of the Federal Power Commission has not been perfected. No steps have been taken in addition to those reported last week. Mr. Meredith is expected to reach Washington next week. In the meantime it is possible that the Comptroller of the Treasury will have rendered a decision in the matter of the employment of personnel by the board. The matter of quarters also remains to be solved. It is probable that the commission will be housed in the Interior Department building, where it can have access to the water-power files of the Geological Survey and those of the Public Land Office.

Coal Priorities Established for Utilities

ON TUESDAY the Interstate Commerce Commission issued Order No. 9, continuing Order No. 7 relative to the use of open-top cars for coal transportation until Aug. 19 and amending it so that public utilities and public institutions will receive priority in the assignment of coal cars. The order was originally granted for thirty days from June 21.

The amendment to Order No. 7 whereby priorities for electric light and power plants are established reads as follows:

It is further ordered that until and including Aug. 19, 1920, all common carriers by railroads within said territory, to the extent necessary in order that public utilities, including street and interurban railways, electric power and lighting plants, gas plants, ice plants, water and sewer works, also hospitals, schools and other public institutions, may be kept supplied with coal for current use but not for storage, be and they are hereby authorized to place, furnish and assign cars to coal mines for the transportation of such coal, in addition to and without regard to the existing ratings and distributive shares for mines upon said railroads; provided no cars shall be so placed, furnished or supplied by any such carrier without written application therefor from the public utility, concurred in by the delivering railroad, showing that such coal is needed for current use, and not for storage, in order that the applicant may continue in daily operation, and provided further, that such coal shall not be subject to reconsignment except to public utilities or public institutions and that a written report of the cars placed hereunder shall be promptly made to the Interstate Commerce Commission by the railroad placing the cars.

In connection with this paragraph a question of meaning is already being raised by public utility men and will in all probability be presented to the Interstate Commerce Commission very shortly for a fuller definition. Some utilities have in storage coal more than sufficient to meet immediate requirements. Whether these utilities will be allowed assignment of coal transportation for their current requirements, or whether they must first use up their storage, is the question that utility operators are asking. If the latter is the case, then the utilities, all of them, must necessarily go into the winter, with all of its transportation tie-ups, with but a few days' supply of coal on hand.

Public Relations Section, N. E. L. A., Postpones Organization

BECAUSE all the geographic divisions were not represented, the newly formed Public Relations Section of the National Electric Light Association, of which J. E. Davidson is chairman, at its first meeting in Chicago on July, which was for the purpose of organizing, merely discussed in a general way the work to be covered and postponed organization until Aug. 1. At that time the work will be divided and sub-committees appointed to handle every possible phase of public relations work.

The following national standing committees are now to be a part of the Public Relations Section: "Co-operation within the industry," "sale of company securities," "establishment of state committees on public-utility information," and "investigation and standardization of regulation of utilities."

Public Co-operation and Need of Fair Taxation Discussed by Ohio Men

LABOR conditions, the dearth and high price of coal and the urgent need of new capital were among the important subjects discussed by the central-station men of Ohio at the twenty-sixth annual convention of the Ohio Electric Light Association at Cedar Point this week. The business sessions were given over to discussions of the reports of standing committees and to addresses of special interest to central-station engineers and managers. The entertainment features embodied the results of much thought.

The work of the central stations during the war overcame much blind prejudice and made the public realize the economic value of centralized generation and extensive distribution of electric energy for all purposes, said C. H. Howell in his presidential address. He pointed out that a wide distribution of utility securities among local customers is a form of co-partnership that has proved very helpful. The public, he held, should be frankly and fully informed about all difficulties that beset the company, especially when these troubles affect the cost or quality of service.

That American civilization is menaced because public utilities, the great agents of the country's material development, are unable to compete successfully for

the necessary capital and labor with which to maintain and extend their service was the opinion expressed by William McClel'and, vice-president of the Cleveland Electric Illuminating Company.

The injustice of the present system of taxing Ohio public utilities was the subject of a paper by C. Dalton of Toledo. He said that central stations and other utilities are taxed on their full book value, while mercantile establishments pay on only a fraction of their true valuation because the latter's books are not subject to public inspection. The taxable value of Ohio central stations was shown to have increased over eleven times in ten years, and the companies were said to be paying from 6 to 11 per cent of their gross income in taxes.

A saving of at least 3,000 tons of coal per day could be effected if the loads on all the power plants in Cincinnati were supplied from generating stations having efficiencies equal to that of the West Side plant of the Union Gas & Electric Company of that city. This statement was made by F. D. Wiatt of Cincinnati in the course of his paper describing the large Cincinnati generating station.

The activities of the Society for Electrical Development were outlined by F. W. Loomis of New York City. W. W. Freeman of Cincinnati, president of the society, speaking as a central-station executive, pointed out some of the advantages of membership. D. L. Gaskill said that small utilities got as much out of the society as the large companies, if not more.

The officers elected for 1920-1921 were: President, Col. Dudley J. Bard, Wooster; vice-president, W. A. Wolls, Columbus; secretary, D. L. Gaskill, Greenville. These will compose the executive committee: C. H. Howell, Coshocton; E. L. Franklin, Warren; Robert Lindsay, Cleveland; O. H. Hutchins, Dayton; Frank Espey, Canton.

Co-operative Campaign Progress in Pacific Northwest

AT A MEETING of the advisory committee of the Northwest Electric Light and Power Association in Seattle on July 15 and 16 a plan was proposed for conducting a co-operative electrical campaign in Washington, Oregon, Utah, Idaho and Montana, along the lines of the California plan. This committee of fifteen members, representing central stations, jobbers and contractor-dealers, has been working for some months to enlist the co-operation of all electrical interests in the Pacific Northwest. It is made up as follows:

Representing central stations—R. W. Clark, chairman, Puget Sound Light & Power Company, Seattle; A. G. McMicken, Portland (Ore.) Railway, Light & Power Company; G. A. Lewis, Washington Water Power Company, Spokane; J. V. Strange, Pacific Power & Light Company, Portland; R. G. Bailey, Utah Power & Light Company, Salt Lake City; J. Ryan Gaul, Montana Power Company, Butte; W. R. Putnam, Idaho Power Company, Boise.

Representing jobbers—H. L. Bargion, Montana Electric Company, Butte; G. W. Hawley, Intermountain Electric Company, Salt Lake City; J. I. Colwell, Western Electric Company, Seattle; R. N. Averill, Fobes Supply Company, Portland.

Representing contractor-dealers—J. R. Tomlinson, Pierce-Tomlinson Electric Company, Portland; R. G. McKenney, Nepage-McKenney Company, Portland; J. F. Nepage, Nepage-McKenney Company, Seattle; W. M. Meacham, Meacham & Babcock, Seattle.

The report of the committee will be presented at the annual meeting of the Northwest Electric Light and Power Association in Spokane, Sept. 8 to 11, when definite action is expected to crystallize the movement into a permanent working influence.

Immediate Appointment of a Fuel Administrator Not Likely

RUMORS to the effect that the President might appoint a fuel administrator during the present coal crisis were stilled at the White House on Wednesday. It was explained, however, by White House officials that later conditions might make the appointment necessary.

There seems to be reason for doubting the possibility of an immediate appointment of a fuel administrator, because no appropriation is available. The previous fuel administration utilized all of the appropriation at its disposal.

Coal Priority Order of Temporary Benefit

WHILE the coal priority order of the Interstate Commerce Commission was not all that could be desired by public utilities, it did bring relief to the minds of many utility operators who have daily been watching their coal pile diminish. In commenting on the order to a representative of the ELECTRICAL WORLD, M. H. Aylesworth, executive manager of the N. E. L. A., said:

"This order should temporarily insure the continued operation of public utilities. Had this order not been issued at this time, many utilities, particularly the smaller ones, would face a more serious coal situation than ever before.

"The Bituminous Coal Commission recommended that the public utilities store coal at once. Of course this has been impossible, nor does the recent priority order of the Interstate Commerce Commission permit the utilities to carry out these recommendations. The order issued extends to public utility coal for current use only, and this requires an immediate definition of the term.

"This order was not issued solely in the interests of the utility corporations, but rather that the people might have a continued lighting service both in the home and in the street and that industry depending on electricity might continue to function.

"It is to be regretted that the public is not fully alive to the fact that public utilities cannot operate without coal and that the few days' supply of coal now in the hands of public utilities is simply a hand-to-mouth proposition.

"If the present order is construed to mean that the priority shall apply only to the daily needs of utilities, it will be very apparent that the first heavy snowstorm or blizzard, or a repetition of the recent railroad strikes, will find the utilities without sufficient coal to operate. In other words, while the two recent orders of the Interstate Commerce Commission will be of temporary benefit to the consuming public, in my opinion it will become necessary for the commission to take more drastic steps if the public is to have light, heat and power during the cold winter months."

Assigned Cars at Mines Only Solution of Utility Coal Supply

ASSIGNED cars at the mines for public utilities is the only solution of the present uncertain supply of coal for public utility plants, J. W. Lieb, representing the National Electric Light Association, told the Interstate Commerce Commission last week, when he appeared at the hearing at which the supply, exchange, interchange and return of open-top equipment was being considered. Mr. Lieb pointed out that costs are being pushed upward to such an extent by the uncertainty as to coal supply that the public utilities are in a very serious situation. He called the commission's attention to the fact that public utilities are receiving only 50 to 60 per cent of the coal for which they have contracts. The inference from his testimony was that the contracts are being violated in order that more free coal may be available for sale at the high prices which can be obtained for spot coal.

Every effort has been made to effect economies in the use of coal, Mr. Lieb told the commission. He related how customers have been rationed and how interconnections between companies have been effected where the interchange of current was to advantage.

Anticipating the charge that one of the objects in seeking priority is to reduce competition with isolated power plants, Mr. Lieb asserted that electric power plants are not being called upon for increased amounts of energy and that they are very anxious to hold to the minimum the use of their power by non-essential activities. He pointed out, however, that authority to disconnect consumers in such a case must come from competent officials. For the power company to undertake to discriminate between consumers would simply invite suits for breach of contract, he said. Mr. Lieb presented tabulations showing the amount of coal used by the public utilities. These, he stated, were taken from the ELECTRICAL WORLD and the *Electric Railway Journal.*

E. R. Burritt appeared for the American Electric Railway Association. His argument was along the same general line as that of Mr. Lieb.

The National Committee on Gas and Electric Service, which is representing the gas and electric interests in Washington in this coal situation, has reopened its offices in Washington, with headquarters at 1,015 and 1,016 Munsey Building.

Confidence of Public Necessary to Utilities, Says Insull

PUBLIC confidence in a utility is seen by Samuel Insull, president of the Commonwealth Edison Company, to be the measure of a public service corporation's success. In discussing the relation of utilities to the public with a representative of the ELECTRICAL WORLD, Mr. Insull said:

"Whether or not a public utility is successful depends on its ability to gain and keep the confidence of the people that it serves. In this its problem is like that of any merchant. Of two merchants doing business side by side, one will be successful because he is rendering service and has won the confidence of the public, while the other will fail because he has failed to give service and has not won the confidence of the public. Where suspicion is found there is always distrust of every move. The utility's problem is basically that of the merchant and must be solved by the winning of confidence that will avoid subjecting its every move to suspicion. With confidence secured it will have no difficulty in receiving a favorable answer to any reasonable demand it may make on the public."

Interplant Telephone Communication Established Over High-Tension Wires

AT LAST successful telephone communication has been conducted over live high-tension lines by the American Gas & Electric Company, which has been convinced thereby that the method employed will solve one of its most important problems, namely, insuring a reliable and less expensive mode of communication between its load dispatchers and interconnected stations. The test which proved the practicability of the method was conducted July 7 and 8 between the company's Atlantic City and Ocean City stations, over a live 11,000-volt, 60-cycle transmission line, 12 miles (19.2 km.) long. Between the transmitting and receiving sets were the windings of the power transformers at both ends of the line and an underground cable, making the equivalent length of transmission about 21 miles (33.6 km.). The demonstration was made in the presence of R. E. Breed, president of the American Gas & Electric Company; George N. Tidd, vice-president and general manager; M. L. Sindeband, electrical engineer, and J. W. Milner, research engineer.

The system employed works on the principle of the wired wireless or directed radio and involves the use of apparatus to tune out the power-circuit frequency. The carrier current for the communications had a frequency in excess of 5,000 cycles. The transmitting and receiving sets were connected with the 2,300-volt buses at each station, but they could have been attached to the 440-220-volt circuits with just as satisfactory results according to engineers who have developed the system. Owing to the fact that the invention is still in the patent stage, details of the apparatus and connections cannot be obtained at this time. The invention is the culmination of several years' investigation and was the conception of Mr. Tidd nearly twenty years ago, although the practical development was made by Messrs. Sindeband and Milner.

Among the chief advantages of the scheme, according to Mr. Tidd, are that the investment and maintenance expense connected with private telephone lines are eliminated, the necessity of paying high rental charges for leased telephone lines is avoided, no interference from power circuits or static is experienced, no disturbance to neighboring telephones is produced, the system can be used with any voltage transmission, the possibility of the power circuits breaking is remote, and even if they all fall to the ground communication can still be maintained provided there is not a dead ground on the lines. The investment for apparatus will be only about $500 a station, said Mr. Tidd, so that the scheme is more economical than an ordinary wired telephone system, and especially so the farther apart the stations are. According to the operators who communicated over the system the audibility is higher than with ordinary telephones.

As an indication of what the American Gas & Electric Company thinks of the system, it is planning to apply the communication scheme to all of its properties in various parts of the United States for system load dispatching.

Bureau of Standards Investigating Lead-Covered-Cable Failures

THE Bureau of Standards has been investigating a large number of lead-covered cable failures in St. Louis, where it was claimed that electrolysis was at least in part the cause of the trouble. One of the factors considered is the question whether more failures have resulted on these cables when in fiber conduit than would otherwise have been the case.

The bureau in following up this point has sent out inquiries to a number of railway and power companies asking whether in their experience lead-covered cables fail more frequently when installed in fiber conduits than when installed in other types of conduit. Particular reference is being made to cables carrying power at 2,200 volts or higher. Companies with experience having an important bearing on this matter are being urged to send any information available to the Bureau of Standards, Washington, D. C., at an early date.

Increased Rates Granted to Indianapolis Electric Companies

INCREASED rates for power and lighting have been granted by the Public Service Commission of Indiana to the Indianapolis Light & Heat Company and the Merchants' Light & Heat Company, also of Indianapolis. By these rates, which became effective on July 4, the charge for power has been advanced 5 mills per kilowatt-hour and the charge for lighting, which had not been changed since 1915, 1 cent per kilowatt-hour. A new primary rate of 7½ cents has been established and the minimum rate has been increased from 50 cents to $1. Standard rate B, for combination power and lighting service, has been increased 8 mills. Municipal lighting and all other rates not included above have been raised 5 mills.

This order of the commission, issued after hearings and investigation covering almost three months, was based on fuel conditions and the increased cost of labor. In the order the commission requests that a simplified, comprehensive rate schedule, embodying not more than six divisions, be filed not later than Sept. 1, instead of the present intricate schedules, which include about thirty divisions. Co-operation between the two companies is also urged by the commission.

Two surcharges had been previously authorized by the commission—one on Sept. 1, 1917, and one on Aug. 10, 1918—to meet increased costs, principally of fuel. The estimated cost of coal was then put at $3.45 a ton, as against the present estimate of $5. Labor costs for 1920, it is estimated, will show a percentage of increase over 1919 more than double the percentage of increase shown for 1919 over 1918.

New York State Leads Nation in Hydro-Electric Output

AMONG outstanding facts derived from figures just issued by the division of power resources of the Geological Survey covering the production of electric power and consumption of fuel by public utility power plants in the United States for the first four months of 1920 is that New York State leads in hydro-electric output, the monthly total for that state reaching 268,736,000 kw.-hr. for April, against 292,336,000 kw.-hr. produced by fuel. California ranks second in production by water power, with 219,475,000 kw.-hr. for April, figures which show a good recovery from the low total of 148,836,000 kw.-hr. in February, caused by conditions of drought; Montana comes third, with 100,008,000 kw.-hr., and Washington fourth, with 95,672,000 kw.-hr.

The total production for April for the nation is put at 3,590,071,000 kw.-hr., divided as follows: By water power. 1,488,948,000 kw.-hr.; by fuels, 2,101,123,000 kw.-hr. For the four months totals are: By water power, 5,351,103,000 kw.-hr.; by fuels, 9,316,135,000 kw.-hr.; total, 14,667,238,000 kw.-hr. These figures are based on returns received from about 2,800 power plants of 100 kw. rating or more engaged in public service, including central stations, electric railways and certain other plants. They check closely with the figures of the ELECTRICAL WORLD printed in the issue for July 3, always bearing in mind that the statistics of the ELECTRICAL WORLD do not include electric railways.

University of Illinois Conducts Short Course for Meter Men

A TWO weeks' "short course for meter men" was conducted by the University of Illinois from June 21 to July 3 at the suggestion of the Illinois Electric Association, which bore the full expense involved. The instructions, shown in detail in the accompanying schedule, consisted of lectures, demonstration and laboratory work and covered the fundamentals of electric circuits and the principles underlying the operation of meters. The work on watt-hour meters was under the supervision of experienced meter men. The first week of the course included work with single-phase meters, and the second week was devoted to a study of polyphase meters, special meter appliances, etc.

A number of manufacturers were invited to co-operate by sending meters and experts to give talks on meters. The detailed schedule of work follows:

MONDAY, JUNE 21

8-12—Registration.
1-2—Classroom—Units, Ohm's law for direct-current circuits.
2-5—Laboratory—Resistance determinations.
7-9—"Get-together" at College Hall.

TUESDAY, JUNE 22

8-9—Classroom—Alternators, Ohm's law for alternating-current circuits.
9-12—Laboratory—Alternating-current circuits.
1-2—Classroom—Principles of indicating instruments.
2-5—Laboratory—Study of indicating instruments.
7-9—Talk by meter company representative.

WEDNESDAY, JUNE 23

8-9—Classroom—Clock and disk constants and gear ratio of watt-hour meter.
9-12—Laboratory—Meter characteristic curves.
1-2—Classroom—Theory of direct-current watt-hour meters.
2-5—Laboratory—Calibration of direct-current watt-hour meters.
7-9—Talk by meter company representative.

THURSDAY, JUNE 24

8-9—Classroom—Principles of alternating-current watt-hour meters.
9-12—Laboratory—Calibration of alternating-current watt-hour meters.
1-2—Classroom—Principles of alternating-current meters, continued.
2-5—Laboratory—Calibration of alternating-current watt-hour meters.
7-9—Talk by meter company representative.

FRIDAY, JUNE 25

8-9—Classroom—Discussion of previous lectures.
9-12—Laboratory—Calibration of alternating-current watt-hour meters.
1-2—Classroom—Discussion of previous lectures.
2-5—Laboratory—Calibration of alternating-current watt-hour meters.
7-9—Discussion of meter records.

SATURDAY, JUNE 26

8-9—Classroom—Discussion of previous lectures.
9-12—Laboratory—Calibration of alternating-current watt-hour meters.
1-2—Classroom—Examination.
2-5—Laboratory—Calibration of rotating standards.

MONDAY, JUNE 28

8-9—Classroom—Polyphase alternators and circuits.
9-12—Laboratory—Three-phase current and voltage relations.
1-2—Classroom—General characteristics of transformers.
2-5—Laboratory—Transformer tests.
7-9—"Mixer."

TUESDAY, JUNE 29

8-9—Classroom—General study of polyphase meters.
9-12—Laboratory—Construction and connections of polyphase meters.
1-2—Classroom—Discussion of polyphase systems and meters.
2-5—Laboratory—Calibration of polyphase meters.
7-9—Talk by meter experts.

WEDNESDAY, JUNE 30

8-9—Classroom—Polyphase meters with transformers.
9-12—Laboratory—Calibration of polyphase meters.
1-2—Classroom—Discussion.
2-5—Laboratory—Calibration of polyphase meters with transformers.
7-9—Talk by meter expert.

THURSDAY, JULY 1

8-9—Classroom—Polyphase meters with transformers.
9-12—Laboratory—Calibration of polyphase meters.
1-2—Classroom—Discussion.
2-5—Laboratory—Calibration of polyphase meters.
7-9—Talk by meter expert.

FRIDAY, JULY 2

8-9—Classroom—Graphic recording meters.
9-12—Laboratory—Calibration of polyphase meters.
1-2—Classroom—Demand meters and power-factor meters.
2-5—Laboratory—Study of graphic meters.
7-9—Talk by meter expert.

SATURDAY, JULY 3

8-9—Classroom—Examination.
9-12—Laboratory—Special experiments and calibration of standards.

The course was attended by thirty-four students during the first week and forty-four students during the second week. Seven meter engineers and meter foremen from six of the largest utility companies of the state acted as laboratory instructors. The students represented twenty-three different electric service companies.

Before the close of the course those attending formed the Illinois Electrical Meter Men's Association for the advancement of metering practice in this state with the following officers: President, R. D. Hart, Peoria; vice-president, H. W. Berning, Matoon; secretary and treasurer, D. Carlson, Oak Park.

Formation of North Jersey Power Company Postponed

CONSTRUCTION of the 200,000-kw. power station, for which the formation of a twenty-five-million-dollar corporation, to be known as the North Jersey Power Company, had been planned by the Public Service Corporation of New Jersey, has been indefinitely postponed.

An account of the project, which was to have been partly financed by prospective customers through subscriptions to preferred stock, was given in the ELECTRICAL WORLD of May 1. In a recent letter to those who had thus far subscribed for stock in the new corporation, Thomas N. McCarter, president of the Public Service Corporation, informed them that, owing to general conditions at the present time, it was deemed inadvisable to carry out the project.

It was stated at the general offices of the Public Service Corporation that subscriptions to the stock of the new company had been sufficient to warrant going ahead, so far as financing was concerned. The deterrent factor was the present situation with respect to fuel, labor and cost of material. It was pointed out that the formation of the new company involved a capital expenditure of a large amount of money at a high rate of interest and that apparatus and material are higher than ever before. This caused the officials of the Public Service Corporation to defer action for the present.

Furthermore, this company, like all of the other utilities, it was stated, is having difficulty in obtaining sufficient coal for present requirements, which are approximately 4,800 tons daily. The operation of a power plant of the size contemplated would increase the amount of fuel consumed from 25 to 50 per cent. Under present conditions no coal reserve can be built up and it would be impossible to obtain the necessary additional amount. However, the company has by no means abandoned its plan, it was stated.

Largest Radio Station Will Operate Five Units Simultaneously

ON THE north shore of Long Island, near New York City, the Radio Corporation of America is about to begin construction of a super-powered radio station, to be known as the New York radio central station, that will simultaneously send to and receive messages from five great nations of other continents. The steel towers of the station will be erected on a 6,400-acre (2,585-hectare) tract lying east of Port Jefferson with a long frontage on Long Island Sound. Preliminary engineering studies have been completed, contracts for all construction material are being let, and a force of radio experts will immediately commence work.

There will be five duplex transmitters and receiving sets which can be operated simultaneously, according to Edward J. Nally, president of the Radio Corporation. As soon as the station is completed, Mr. Nally said, message service will be established with France and Germany to supplement the existing commercial circuits, and ultimately radio from this station will connect up Buenos Aires and other points in South America as well as Poland, Sweden, Denmark and other European countries.

The form of aërial construction to be used is somewhat unusual. From the central power house six spans of aërial wire will radiate in a star pattern to a distance of more than a mile from the center. The wires of this antenna will be supported on 400-ft. (120-m.) steel towers with the wires suspended at the top between 150-ft. (45-mm.) cross-arms. Each of the six antennas will have twelve towers. Five of the antennas will be used for regular service, while the sixth is reserved for emergency operation.

The generation of energy for each of the five units will be effected by Alexanderson alternators, the same as are now used at the New Brunswick (N. J.) station. There will be two 200-kw. machines for each transmitting station.

Another departure in radio engineering will be the utilization of what is termed a multiple-tuned antenna, which, Mr. Nally explained, materially reduces the electrical resistance of the long, low, flat-top aërials.

Receiving aërials are also of a new type and are designed for operation with the Weagant system of static elimination.

Lighting Data File

A FILE of lighting data is being compiled and distributed monthly in the form of bulletins by the Edison Lamp Works of the General Electric Company. Each of the bulletins covers a different phase of lighting. Lamp characteristics, the effect of different voltages, relation of lighting to merchandising and to production, lighting of factories of one kind and another and other places of works, etc., each forms the basis of a separate bulletin.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Growth of the Telephone in London.—London, which has never been in the front rank of the world's great cities as regards the general use of telephones, is catching up, sixty new exchanges and 250,000 new subscribers being expected in the next twenty years as a result of plans for extension of service now being made.

American Iron and Steel Institute Report.—The annual statistical report of the American Iron and Steel Institute for 1918 has just been issued. Besides complete figures on the production of iron and steel, tinplates, galvanized sheets, pipes and tubes, etc., it contains tabulated data on the production and shipments of coal and of coke, arranged by states, for the five years from 1914 to 1918 inclusive.

Water-Power Possibilities in Utah.—A survey by the United States government is in progress in the vicinity of Salt Lake City for the purpose of determining the water possibilities and possible power sites along a great portion of the Wesatch Mountains. This survey will eventually take in most of the canyons from Ogden to Nephi and will result in the gathering of valuable data that may be used by the city of Salt Lake now that the water-power bill has become law.

Rat Puts Plant Out of Commission.—Perhaps no source of electrical trouble is harder to guard against than the depredations of animals. A case in point is reported from a large British plant where on the chief electrician's switching in an explosion occurred, injuring him severely, smashing insulators and rendering the busbars and contacts useless for the time being. In the search that ensued it was discovered that the short circuit had been caused by a large rat which had got athwart the busbars and achieved a noisy and spectacular suicide.

Atlanta Company Favors Maximum Kva. Demand.—Application for an increase in electric lighting, heating and power rates, as well as in street-car fares and gas rates, has been made by the Georgia Railway & Power Company of Atlanta to the Georgia Railroad Commission. A noticeable feature of the proposed rates as applicable to wholesale power is the determination of the primary charge on a maximum kva. demand instead of a maximum kw. demand. The commission set July 20 as the limit date for filing briefs, and a decision on all features of the petition is expected shortly thereafter.

The Radio Compass in Seaplane Navigation.—Successful navigation of naval seaplanes by radio compass up to the distance of 200 miles is assured by a test completed recently at Hampton Roads. The test was between seaplane F5L, Anacostia air station, and the U. S. S. Ohio. The F5L left Hampton Roads and flew direct to the U. S. S. Ohio, 94 miles distant. The position of the ship was unknown to the plane, which navigated by radio-compass signals. Communication was perfect throughout the flight, and the time indicates that the plane followed the most direct course. The plane returned to Hampton Roads without landing, navigating entirely by radio compass.

Toronto University to Have New Electrical Engineering Building.—A building for the departments of electrical engineering and applied mechanics is now in process of erection at the University of Toronto, Canada. It will be a brick and sandstone structure, four stories in height, measuring 225 ft. x 68 ft. On the ground floor will be two lecture rooms, a library and rooms for the teaching staff. The rest of the building will be devoted mainly to laboratories. Electrical engineering will be provided with three large laboratories for the study of alternating-current equipment, direct-current machinery and electrical measurements respectively. Another room will be arranged to study safely problems of high tension. Questions of insulation, conductivity and magnetic properties of materials will be dealt with in separate rooms. Several small rooms will be used for research, and communication engineering, including radio-telegraphy, will be provided with space on the upper floors.

Electrical Progress in Holland.—Dutch manufacturers are clamoring for cheaper electrical power, and a project to spend $4,000,000 or more in this direction is taking shape. Since 1913 the consumption of electrical energy in Holland has more than doubled, and it now reaches between 35 kw.-hr. and 40 kw.-hr. annually for each inhabitant. The scheme for extension was at first broached along the lines of private enterprise, with the government prepared to take a large interest in the operating company; but this plan has been rejected in favor of state action, co-operation with existing undertakings to be had on a profit-sharing basis and the construction of an extensive system of transmission lines to be begun at once. For the high-tension network three-phase, 50-cycle energy is to be adopted, the minimum voltage being 50,000. The capacity recommended for the power stations supplying the system is from 30,000 kw. to 75,000 kw. Each station will be equipped with generators developing 15,000 kw. A yearly output of 100 kw.-hr. per capita is aimed at, or an output of 1,000,000,000 kw.-hr., on the assumption that in the thirty years required to complete the project the population will have grown to 10,000,000.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Chicago.—The twelfth annual outing of this club is scheduled for Thursday, July 29.

New York Electrical Society.—This society has issued a sixty-four-page booklet containing the constitution, by-laws, list of officers and past-presidents and a roster of membership.

American Institute of Mining and Metallurgical Engineers.—This society will hold its fall meeting from Aug. 20 to Sept. 3, leaving Buffalo, N. Y., by steamer and cruising through the lakes.

Association of Iron and Steel Electrical Engineers.—Sept. 20 to Sept. 24 inclusive have been selected as the dates for the fourteenth annual convention of this association, which will be held at the Hotel Pennsylvania, New York City. The program under preparation will deal with the whole range of plant electrification. Seventy-one representative electrical and allied manufacturing companies will take part in a display of products of particular interest to steel-mill engineers.

Meetings of Summer and Early Fall.—Among meetings of electrical bodies to be held before the end of September are the following: Michigan Section, N. E. L. A., Ottawa Beach, Mich., Aug. 24-26; Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 8-11; New England Geographic Division, N. E. L. A., Kineo, Me., Sept. 14-16; Indiana Electric Light Association, French Lick, Ind., Sept. 15-17; Illuminating Engineering Society, Cleveland, Ohio, Sept. 27-30. The Electric Furnace Association will meet in New York City in September and the Colorado Electric Light, Power and Railway Association in Glenwood Springs, Col., in the same month.

A. I. and S. E. E., Chicago Section.—At the final meeting of the Chicago Section of the Association of Iron and Steel Electrical Engineers for the 1919-1920 season Thomas O. Organ, consulting engineer for the Keystone Lubricating Company, delivered an illustrated address in which he explained the relative merits of oil and grease for different lubricating requirements. The election of the officers to serve next season resulted as follows: Chairman, Gordon Fox, electrical engineer Steel & Tube Company of America, Indiana Harbor, Ind.; vice-chairman, Elbert Lewis, Illinois Steel Company, South Chicago, Ill.; executive committee, R. R. Shepard, electrical superintendent Steel & Tube Company of America, and James Mills, electrical engineer Illinois Steel Company.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Contract Approved Subject to Subsequent Valuation.—The Idaho Public Utilities Commission has approved a contract for street lighting between an electric company and a municipality which contains a provision for making retroactive to the date of beginning service the rates subsequently to be fixed by the commission, it appearing desirable to install a new system of street lighting at once without awaiting completion of detailed inventory and valuation.

Allocating Property of Joint Gas and Electric Company.—In apportioning the property of a company furnishing both gas and electric service the items of property which were of a composite character and used in both departments of the business were correctly allocated as between the departments upon the same ratio as the property which could be directly assigned to the respective departments, according to a recent decision of the New York Public Service Commission, Second District. The income from the electric department, the commission also held, had no bearing on rate fixing for the gas department.

Maryland Commission Will Protect Utilities Against Undue Competition.—The Maryland Public Service Commission announces its adoption of the policy that when a public utility is rendering to the public a service reasonably adequate and is intelligently and economically operated, that utility will be permitted to earn a fair return on the property dedicated to the public service after the payment of operating expenses, taxes and a reasonable allowance for depreciation, provided that such return can be obtained through rates not above the value of the service, and the utility will be protected against unnecessary, undue and indiscriminate competition.

Contracts Must Not Be Voided Without Authority from Commission.—The Washington Public Service Commission has ordered the North Coast Power Company to repay to the city of Centralia the full amount of rate increase collected by the company from the city between Dec. 20, 1919, and July 1, 1920. The company had, in the absence of a formal protest from the city, put the new rates into effect on the former date and rescinded the old contract without authority from the commission. The latter body had authorized the increase but not its immediate enforcement or the cancellation of the existing agreement. The new rates therefore are held to have been invalid prior to July 1.

Maintenance Reduction False Economy.—In granting to the Pacific Gas & Electric Company and the Great Western Power Company permission to add an emergency surtax of 15 per cent to all bills rendered between July 10, 1920, and April 10, 1921, and add to the standard rates the surcharges previously allowed, the Railroad Commission of California declared that shortage of water power and increase in wages justified the increase in rates until the installation of additional hydro-electric equipment shall make it possible to reduce the consumption of fuel oil. "The company's property," the commission said, "should be maintained in first-class condition. It would be false economy to reduce maintenance at this time. It would result only in decreasing the quality of service in the future."

Flat Rates to Agricultural Consumers Unfair.—In refusing to alter the rates fixed by it for the San Joaquin Light & Power Corporation on the complaint of the Kern County Farm Bureau that they were excessive and that because of increased rainfall and an alleged surplus of natural gas no power shortage need exist, the Railroad Commission of California said: "The evidence shows that the average increase in rates for the remainder of the year for agricultural service will be slightly in excess of 15 per cent; that the increased cost of service has been in the form of increased operating expense, depending upon the use of energy rather than upon the size of the installation; that the flat rates formerly in effect were unfair to the consumer using power less than the average, and that consumers using motors continuously were not paying their just proportion of the cost. Under the proposed rates consumers who can conserve in the use of water will receive the benefit of the reduced cost of service, a condition not possible under the former flat rates."

Power Sales in Washington State.—In a recent ruling by the Washington Public Service Commission (see ELECTRICAL WORLD, July 3, page 39) the earnings of the Puget Sound International Railway & Power Company on its Everett business, which had been 43.60 per cent upon power sales and 11.61 per cent upon lighting sales, were reduced to 8 per cent upon the property valuation. In issuing this order the commission accepts the company's challenge of its jurisdiction for regulatory purposes over electrical energy sold for power and undertakes to evaluate the lighting and the power systems separately for rate-making purposes. It is considered certain that this ruling will be contested in the Supreme Court, a former Supreme Court decision having held in effect that sale of surplus or "dump" power should not be considered a public use, subject to commission regulation, but as subject to the company's own control. The commission maintains that at Everett the sale of power is an established business and not affected by the court ruling.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Eighteen Years' Silence Does Not Outlaw Suit for Damages from Overflow.—That a defendant had not previously protested against a dam, although eighteen years had passed since it was built, was no bar to recovery of damages for flooding of land, the Supreme Court of New York has held in a suit brought against a pulp and paper company. (181 N. Y. S. 714.)

Safety Factor in Construction of Dams.—In an action for damages because of the breaking of a dam, the Supreme Court of Ohio has laid down the general principle that one constructing a dam across a natural watercourse must construct the dam with reference to the ordinary conditions of nature, but it is not necessary to make the dam so strong as to withstand an extraordinary convulsion of nature or an extraordinary flood—one which ordinary prudence would not have foreseen. (127 N. E. 408.)

Contributory Negligence Despite Warning Prevents Recovery of Damages.—In a suit against the Metropolitan Edison Company to recover damages because of the death of a painter who swung a scaffold on a tower in such a way that his head was only six inches under high-tension wires attached to the tower and who in some unexplained manner came to grasp one of the conductors, it was established that he had been warned about the wires and told to keep away from their neighborhood until the current was turned off. The painter failed to observe this order, and the Supreme Court of Pennsylvania has found that because of his negligence the lower court rightly found for the defendant. (110 A. 92.)

Massachusetts Department Without Power to Prevent Modification of Contract in Accordance with Approved Provisions.—Where the Department of Public Utilities has approved a contract which provides precisely how any modification of price necessitated by changed conditions shall be made, the department cannot prohibit such modification, under such specified conditions, the statute not conferring on it the right to fix a price nor giving it more than a limited function to ascertain whether the conditions calling for increase in price as specified by the contract have come about. This is the purport of the decision of the Supreme Judicial Court of Massachusetts in an action brought by the Boston Consolidated Gas Company against the Department of Public Utilities of the state. (127 N. E. 417.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

James E. Davidson, vice-president of the Nebraska Power Company, who was chosen to head the new Public Relations Section of the N. E. L. A., the executive committee of which met last week for the first time, has long been recognized for his activity in developing and strengthening association work. He has been president of the Vermont Electric Association (1909), chairman New England Section, N. E. L. A. (1910-1911), president Northwest Electric Association (1911-12) and chairman of its executive committee (1915-17), and president Nebraska Electric Association (1918). In 1915 he was elected a member of the N. E. L. A. executive committee. Mr. Davidson went from the Port Huron (Mich.) utilities to Montpelier, Vt., where he was president and manager of the Consolidated Lighting Company. In 1910 he left New England for the Northwest, to assist in the development of the Pacific Power & Light Company. Two years later he became vice-president and general manager of that company. He came East for the Electric Bond & Share Company in 1917, and toward the middle of the year he was appointed vice-president and general manager of the Nebraska Power Company at Omaha.

J. E. DAVIDSON

E. A. Baily has been appointed treasurer of the Brooklyn Edison Company to succeed the late Henry P. Erwin. Mr. Baily was formerly secretary.

E. W. Kells has been appointed secretary of the Brooklyn Edison Company, succeeding E. A. Baily, who has been appointed treasurer.

F. A. White, manager at Sweetwater, Tex., for the Texas Power & Light Company, has resigned.

D. W. Jardine, for the past seven years assistant manager, has been chosen to succeed F. H. Parker as manager of the Burlington (Vt.) Light & Power Company. Mr. Jardine since his graduation in 1907 from Lehigh University has been in the employ of the parent company, the American Gas Company.

Irving E. Moultrop, assistant superintendent of the construction bureau of the Edison Electric Illuminating Company of Boston, has been elected a trustee of the American Society of Mechanical Engineers and a member of the Engineering Foundation Board to fill the vacancy caused by the death of E. Gybbon Spilsbury on May 28 last. Mr. Moultrop is also chairman of the Technical Section of the National Electric Light Association.

A. C. Miller has been promoted from foreman of the Pacific Gas & Electric Company's electric shop at Redding, Cal., where he has been for seven years, to manager for the company in Shasta and Trinity Counties, Cal.

M. E. Todd, who has been an instructor in electrical engineering in the Dunwoody Industrial Institute, will next fall take up general work in the electrical engineering department of the University of Minnesota.

J. H. Kullman, formerly a designer with the Electric Machinery Company, will become an instructor in electrical design at the University of Minnesota this fall.

F. H. Parker, after forty-four years of service with the Burlington (Vt.) Gas Light Company, which later was merged with the Burlington Light & Power Company, of which he was manager, has resigned. Mr. Parker's connection with the Burlington properties began two years after his graduation from the University of Vermont in 1874. In 1886 the gas company began furnishing electric light under the title of the Brush-Swan Electric Light Company. In 1892 that company absorbed its competitor, the Citizens' Electric Company, and in 1902 the Burlington Light & Power Company was formed for the purpose of operating the plants of the Burlington Gas Light Company, the Consolidated Electric Company, which furnished electric light only, and the Vermont Electric Company, which furnished electric power only. Throughout this enlargement of service in Burlington Mr. Parker continued as manager. In 1908 he was elected president of the Vermont Electrical Association.

G. R. Stahl, engineer for the People's Light Company, Davenport, Iowa, has been named assistant general manager of the company, with which he has been connected for a number of years.

L. J. Greer, formerly manager for the Texas Power & Light Company at Gainesville, Tex., has succeeded F. A. White as manager at Sweetwater.

Capt. Richard H. Ranger, after three years of service with the army, has resigned from the Signal Corps to take up work with the Radio Corporation of America under E. F. R. Alexanderson, chief engineer. During his service he came into close touch with the French radio service. This included a period at the station at Lyons, which is the most important radio center of that country. The training of cadet officers in signaling became an important part of the army work in France, and Captain Ranger was a member of the instruction staff of the First Corps signal school at Goudrecourt. Later he was put in charge of the department of military signaling at the Saumer artillery school, where at the signing of the armistice there were 2,200 cadet students. After the armistice a thorough course in radio at Sorbonne University was organized by the French specialists, and Captain Ranger handled the translations of these lectures. Research work on eliminating interference in radio receiving was conducted that led to a new type of apparatus which was further developed on returning to this country. For the last year Captain Ranger has been in charge of the Signal Corps radio laboratories at Little Silver, N. J., where it has been the endeavor to put into substantial, usable form the instruments which the war demonstrated to be necessary for the equipment of the army. Captain Ranger was graduated in 1911 from the Massachusetts Institute of Technology.

R. H. RANGER

Obituary

Axel Carl Ekstrom, consulting electrical engineer, Delaware & Hudson Company, died July 1 at his home in Ballston Spa, N. Y. Mr. Ekstrom was born in Stockholm, Sweden, fifty-eight years ago. He came to the United States in 1890.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Electric Heating Appliances Increasingly Popular

WITH the approach of hot weather heating appliances have been coming more and more into popularity with housewives who appreciate the advantages of a quick initial supply of heat and great concentration. In the item of flatirons, for instance, sales are extremely heavy because of numerous campaigns run by the power companies. Percentage increases in sales are not so high as on other items because the market has been nearer saturation.

A recent report of the California Electrical Co-operative Campaign covering sales of such material on the Pacific Coast shows that users of electric percolators increased 104 per cent in 1919 over 1918, toasters 100 per cent, ironers 137 per cent, and 6-lb. irons 33 per cent. In New England territory recently some jobbers were so hard pressed to meet clamoring customers that they sold goods ordered early in the year and reserved for the 1920 Christmas season. Nor did general price increases about the middle of June appear to have any deterrent effect upon a demand in the Middle West which had been steadily increasing.

Distribution of heating appliances in the South is on the allotment basis, and dealers are urged to place their orders with jobbers at the earliest possible moment, as the latter have been unable to accumulate any stocks for fall trade. Jobbers' shelves in the metropolitan section are absolutely bare, and there seems to be no let-up in the demand.

The price trend in this line seems to be steadily upward. Manufacturers are faced with transportation troubles and an inability to obtain sufficient raw material. One producer of appliances made general price increases on July 1 amounting to from 6 to 15 per cent. Another is expected to follow his example within a week.

Here and there are heard reports of slackening demand, but in most cases this evidence seems to emanate from scattered jobbers throughout the country, and as likely as not the contrary view will appear to be the case the following week.

Foreign Demand for Steel Towers Good

STEEL transmission towers are reported in better demand for foreign work than for domestic. This is especially true of the large units. At the same time there is a fair demand for smaller towers, both tubular and fabricated, and in amounts for use over relatively short distances.

Although European exchange is rather unfavorable, there is some demand at this time from that source, while inquiries are good. Buying prevails in the Far East, Australia, South America and Canada.

Poor condition of power companies and high rate of borrowing money are the reasons advanced for a rather light domestic tower market. The power and light companies are interested to the extent of inquiries, and are keeping their plans rather forward for new extensions, but at the last moment the signature is lacking on the dotted line.

There is a shortage of material available for poles, but more particularly for tubular poles. The pipe demand in the oil regions is tremendous, with a consequent reaction on the amount of stock that can be turned into poles. Some fair street-lighting business is reported, however, for this class of pole. For fabricated poles supply in some quarters is a little short because of transportation hold-ups.

A rather new use for steel poles and towers is that in the radio field. Since the armistice, and later with the withdrawal of restrictions on certain classes of radio work, the demand in this field has increased, and it is in good condition at this time. It is understood that a recent order embraced twenty-four towers of 400-ft. length.

Deliveries on this material are lengthening and in some cases are running up to six months. At the same time prices quoted are holding rather steady.

Appeal Filed in Coolidge Lamp Patent Case

WORD has just been received from Dr. Liebmann of the Independent Lamp & Wire Company that that company has filed an appeal from the decision in the Coolidge lamp patent case, handed down on June 29 by Judge Morris of the United States District Court in New Jersey, wherein all the claims brought by the General Electric Company were declared valid and to have been infringed.

Hot Weather Would Leave Short Fan Stocks

IT IS probable that the fan season will not come up to the expectations expressed some months ago when the volume of initial orders was so heavy. The reason assigned for this apprehension is more a lack of transportation than a lack of orders. Mills have been up against the slow movement of raw materials into the plant as well as delays in getting the fans away from their doors. Jobbers have in many instances received only parts of their shipments, so that they have been compelled to buy from the trade to satisfy the orders for fans from their dealers.

At the same time, the fan season has been late in opening all over the country because of protracted cool weather. This was a fortunate occurrence, because had the season opened early jobbers would have been unable to come close to satisfying the demand. It must be remembered, however, that the products of some manufacturers were in their distributers' hands before the worst traffic jam resulted, but in many other instances this was not the case. Some distributers, therefore, opened the season with good supplies of fans.

At the present time there is a fair assortment to be found in the New York district because warm spells have been spasmodic. The call had hardly started when it was as quickly stopped. Before it has been resumed, a new shipment has appeared and stocks are built up a little; but it is generally recognized that a normally long-protracted spell of hot weather would soon clear these stocks to the point where they would be of little value except as substitutions.

In the business districts of New York City there hasn't been enough hot weather to move the direct-current oscillating fans in great quantities. Good stocks of these are

available. On the contrary, alternating-current oscillating fans are in low supply, and it is not expected that they will last out the season. Ceiling fans have moved in volumes surpassing all expectations, and there are few of the alternating-current type left. As usual, the 16-in. alternating-current oscillator is the favorite, although the 9-in. and 12-in. sizes are receiving a good call. Demand for the small sizes is good for apartment-house and home use. These are receiving more consideration because of the price feature, as in many quarters this item is of more importance than when fans are considered for business use.

NEW ENGLAND NOT UP TO EXPECTATIONS

Continued cool weather has held back the sale of fans in New England this summer, to say nothing of existing prices. It is a common saying in the wholesale trade that after July 4 the fan business amounts to little except in retail circles, and so far this year's business does not show much more than a normal demand. Some jobbers report sales from 25 to 50 per cent in excess of last year's, but others have done no better to date than was the case under the cool conditions which prevailed during much of the summer of 1919. Stocks are not large, however, and the total number of fans in the hands of seventeen leading jobbers in this district on June 30 was about 7,000 to 7,500, individual stocks ranging from 25 to 1,200. It appears likely that two or three hot waves will exhaust these reserves, and as few fans are likely to be purchased after this for 1920 delivery, the chances of any material carry-over into next year are small.

The oscillating type of fan is selling best this year. Fans of the larger sizes are moving better than residential fans, a leading jobber reports. The former are going into factory service, where initial cost carries less weight. Comparatively few fans were carried over from last year by New England jobbers. Not much complaint has been heard as to deliveries this spring, orders having been placed far enough ahead of requirements to yield very fair shipments even in the face of the unusually slow railroad service, which has been such a handicap to manufacturers and distributers in all parts of the country.

It is estimated that the New England market absorbs from 100,000 to 150,000 fans a year, according to weather conditions. Retail stocks are still pretty well filled. The feeling is widespread that prices cannot go much higher on desk fans without a decided reduction in the total volume of sales. Some cut-price sales are being conducted at present, but by and large the price level is being maintained at record-breaking figures. There is a general disposition to hold back on commitments to next year's fan program, many distributers preferring to play a waiting game in the hope that prices next winter for 1921 fan delivery will be materially lower than they were last time the seasonal orders were placed.

Few jobbers are ready as yet to say how many fans they will purchase for next year. They may have particular totals in mind, but feel that nothing will be lost by letting matters rest for a few months. In case stocks are cleaned out by hot weather, still largely deferred, the market will be vigorously canvassed for any 1920 "left-overs" that may be in sight. One large Boston house would be glad to get 200 more fans this summer, but most of the distributers with whom the ELECTRICAL WORLD has been in touch are practically through with fan buying for the present, barring protracted torrid weather.

During the last week, however, sales showed a decided spurt because of the warm weather, but jobbers' stocks are still meeting current requirements.

MID-WEST HAS FAIR STOCKS

During the greater part of June the demand in the Mid-West was very good. While this period of mid-summer heat was on, jobbers' stocks were in a fairly good condition to meet requirements because the call had come late. They were having difficulty, though, in replenishing these stocks, as shipments were coming in slowly from the factories.

By the end of the month cooler weather set in again and stocks began to pick up. At the present time continued unpleasant weather has further reacted on sales through dealer and jobber, while receipts have been better, and it is felt that unless more heavy hot weather comes on soon stocks can be maintained through the season. They are now in fair shape, but below the average.

Demand in general is reported lighter, in line with lessened demand for other socket appliances. As usual, the 16-in. oscillating fan is the best seller.

SOUTHERN STOCKS DEPLETED

Exceedingly warm weather since the middle of June has played havoc with jobbers' stocks. These stocks in the first place were small enough because of embargoes in the East, but there are still some shipments reported in transit for a long time. Some jobbers have almost nothing left in stock, and the call for direct-current non-oscillating fans and for 12-in. and 16-in. oscillating fans has been insistent. At the same time, there are not enough ceiling fans to go around. In this region, too, jobbers expect that future receipts which may come in will not to any degree supply the demand which they feel will develop before the end of the season.

NORTHWEST SEASON LIGHT

In Seattle and the Puget Sound district, as a whole, there is no season which can be specifically designated as a "fan season." During June, July and August, as a rule, there are a few days when fan sales are good, but this movement is spasmodic. It is not unusual for an entire summer to pass with only a few really warm days. However, jobbers do carry a fair assortment of stock, which is amply sufficient for a trade necessarily light. Stocks for this year's trade were ordered six months in advance, and at the present time jobbers are well supplied. Up to date the present summer has shown no need whatever for electric fans.

Need of Standards in Fractional Horsepower Motors

THE fractional-horsepower-motor business has grown so rapidly that standards seem to have been overlooked or ignored by both manufacturers and buyers. The need of greater production from the motor manufacturers impelled the American Washing Machine Association to confer with the motor manufacturers for the purpose of establishing standards which would make the motors mechanically interchangeable. The Power Club has standardized shaft sizes, and a committee of that organization is grappling with some of the electrical problems of standardization.

Most of the purchasers of very small motors are not electrical engineers, and they are confused by the great variation in the performances of motors from the same or different factories. However, when certain motors are rated all the way from ⅛-hp. to ½-hp., depending on the duty cycle, there will naturally be a wide spread in their full-load performances at the different ratings.

Buyers want the fractional-horsepower motors to standardize their machines and reduce the numbers of ratings so that motors with the same nameplate reading will be electrically and mechanical interchangeable. The great non-technical buying public seems to think that it has a right to this service, which, it is claimed, would also benefit jobbers, dealers and the manufacturers themselves. There are manufacturers, however, who feel that such mechanical uniformity would hamper progress in the improvement and development of new ideas and who do not take agreeably to the idea of uniform design.

To a limited extent, practically all manufacturers are working toward standardization, as, for instance, the diameter of the shaft extension, size of keyways, size of pulley, etc., but it seems to be mechanical rather than electrical standardization which up to the present time is being considered.

Power Companies Ordering Cable Well

POWER cable orders are being received by the mills in good quantities. Shipments are being quoted in increasingly longer terms, running from three to eight months for paper and lead cable and from six weeks to four months for varnished-cambric and lead cable. A tendency is noted for the orders to run into larger sizes of cable, which forms some check on reports that fiber-conduit orders are also running to larger sizes.

The Middle West is providing the best market, but fair-sized orders are coming from New England, the Atlantic States and the South. Some good orders are coming from electric railroads and street-railway companies.

In at least one case paper-cable producing capacity is sold throughout the best part of the present year, and no orders will be booked beyond Jan. 1, 1920. At the same time, many utilities are unwilling to book orders for shipment as long as six months. Utilities of regular standing at the mill, however, are generally able to squeeze in an order, if necessity warrants, where an outside customer would have to wait his turn.

An interesting trend toward standardization is found in the orders from utilities. Former habits of specifications all their own are being changed, and the engineers are coming to see that they can use cable built on A. I. E. E. specifications as well as that built on their own. The mills are refusing to accept special orders in many instances, and this is helping in the standardization.

Metal Market Situation

FIRMNESS continues as the prevailing tone in the copper market, and a growing volume of both foreign and domestic inquiries is reported. Producers continue to hold at 19 cents for third-quarter delivery but seem shy about accepting orders for later than September. Smaller dealers are being forced from the outside market, which is now unwilling to sell for much less than 19 cents. London spot closed £3 15s. higher than a week ago under the influence of improved business conditions. Although buying is rather light, steadiness rules in the market for zinc, which advanced a fraction of a cent. Tin also closed higher with an increase of 2 cents, while minor price changes of not more than a quarter of a cent occurred among the old metals.

The Interstate Commerce Commission has extended its order confining the use of open-top cars to coal for thirty days from July 21. This is against protests of the iron and steel producers, who said that shutdowns of their mills would be inevitable if this extension were put into effect. All flat-bottom gondola cars or cars which on June 19 had been definitely withdrawn from coal-carrying service have been exempted from this order, as was requested by iron and steel interests, thereby affording a certain amount of relief.

NEW YORK METAL MARKET PRICES

	July 6	July 13
Copper	£ s d	£ s d
London, standard spot	87 0 0	90 15 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75	19.00
Electrolytic	19.00	19.00
Casting	18.00	18.25
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.00	8.00
Antimony	7.50	7.50
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.15	8.25
Tin	48.25	50.25
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.00 to 15.55	15.00 to 15.75
Brass, heavy	9.00 to 10.00	9.00 to 9.75
Brass, light	7.00 to 7.25	7.00 to 7.50
Lead, heavy	7.00 to 7.25	7.00 to 7.25
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

VACATION season trade slackness is beginning to affect the electrical industry, with jobbers throughout the country reporting lighter sales than for some weeks past. A favorable feature, however, is the freight situation, which seems to be easing up considerably in all parts of the country, with one exception; in the Puget Sound district a 50 per cent normal supply of cars is tying up the lumber industry.

Labor in the East and South is in good supply, with a somewhat stronger demand on the West Coast, where a slight shortage of farm labor is expected to be relieved by an exodus of hands from the closed lumber camps.

Building construction in Middle Western territory is still off, but in other localities a good volume of this work is being undertaken, especially in the nature of large industrial projects.

In some sections, notably in Southern and New England districts, creditors are a bit panicky over the financial outlook, with the result that collections are tightening up. In other localities collections are fairly easy, as on the Pacific Coast where money is said to be plentiful.

NEW YORK

The summer vacation exodus is having its effect in a general easing off of business that begins to make itself felt. Jobbers report the market as a bit quiet the past week, and contractor-dealers are slowed up through the paucity of residence construction. Building work for industrial and business purposes, however, continues at a great pace, though many of these projects are still in the preliminary stages and have not made themselves felt on the electrical industry as yet.

Reports on the shipping situation are for the first time in many months in a measure favorable, for an increasing volume of freight is arriving on back orders, although anything in the nature of stocks has not yet had time to accumulate. Collections are fair and prices are generally steady.

The feature of the market is probably the relief in the acute situation as regards flexible armored conductor which several jobbers report during the week. No stocks are available, but receipts are better. Pipe is still out of the market, and sales of fans are poor, indications pointing to an off-season in that line. Lamp stocks are building up in good shape against anticipated heavy demand in the fall.

Metal Molding.—No material is being received from the steel mills, and consequently some shortage is met, with stocks spotty in face of a demand that is only "fair."

Fans.—Good stocks are generally reported. Jobbers agree that demand has been light this season, with a poor fan season in prospect unless prolonged hot weather saves the situation. Shipments are fairly regular.

Flexible Armored Conductor.—Some easing up of the previous shortage is reported by jobbers during the week. Shipments are arriving more regularly, but back orders will prevent any semblance of stocks for several weeks to come. From $115 to $117.50 is quoted on No. 14, 2-wire.

Rigid Conduit.—With not a foot in stock, and irregular shipments that at once melt in the face of back orders, many jobbers have ceased to quote prices. Demand holds up as strongly as ever.

Flashlights.—No difficulty is experienced in this line, which has a very rapid turnover. Shipments are good and stocks in such shape as to handle the brisk call which exists.

Wire.—Good supplies in general are the rule, with a

reasonable demand existing. Bare copper wire seems easy, with weatherproof slightly harder to obtain. No. 14 rubber-covered is quoted at $11 and upward per 1,000 ft.

Safety Switches.—Poor local trade has enabled good stocks to accumulate. Shipments range from six weeks to two months. Although one manufacturer announces a reduction of 13 per cent on his three-pole, 30-amp., 250-volt switch, no other price change is reported.

Lamps.—Better deliveries have enabled jobbers to build up stocks which have been spotty, in anticipation of a large demand this fall. Sales are normal for this time of year.

Heating Appliances.—A demand that far outstrips supply has left shelves practically bare. Deliveries are extremely slow, and one manufacturer has raised the price of irons and toasters 6½ per cent and that of percolators 10 to 15 per cent. Other increases are in sight.

Schedule Material.—In spite of good average stocks, with here and there a short item, jobbers look for a shortage in this line as a result of labor troubles closing New England factories and the general dearth of brass and porcelain material. Shipments at present are satisfactory.

Electric Ranges.—Local territory offers a poor market because of the high energy rate. Distributers report good business in outlying districts, however. Jobbers' stocks are in such shape as to handle the demand. One manufacturer advanced his price from 15 to 25 per cent on July 1; another made an increase of 8 per cent on July 15.

CHICAGO

All stocks, particularly schedule material and wire, show an improvement, as sales continue on a lower scale than during the spring. Inbound shipments are being handled by the railroads with greater regularity so that jobbers are enabled to build up stocks. These stocks are necessarily very broken, and on many items the increased supply is not yet sufficient to cover the accumulation of back orders. The improvement of freight conditions may be only temporary as the movement of fruit and produce, which is increasing every day, threatens the handling of non-perishable goods.

Construction remains at a minimum, the current week's permits for Chicago totaling only $635,000. This makes business light for contractor-dealers. Retail sales of household appliances in Chicago are also slack, with washing machines and vacuum cleaners holding up better than the rest of the line. Unseasonable weather, which continues quite cool, undoubtedly affects this class of business materially. Manufacturers report sales campaigns in smaller cities in surrounding territory as having unvarying success.

Wire.—With the single exception of magnet wire, all kinds and sizes are much easier to obtain and stocks are accumulating in fair shape. Demand has fallen off considerably and prices are unchanged.

Motors.—Large jobbing interests report the receipt of several cars of motors of 5-hp. size and larger and a material relief in delivery conditions. Fractional sizes are still unobtainable, as orders exceed visible supply for some time to come.

Poles.—No change is apparent from the last report. Production barely keeps pace with demand and shipping is uncertain, particularly since the advent of the fruit season. Stocks are badly broken, frequent substitution being necessary to fill requirements.

Cross-Arms.—General relief in transportation does not seem to have extended to carload shipments from the Pacific Coast, as cross-arms, plentiful in the producing yards, are still hard to get here; $123.90 is being quoted on 6-ft., six-pin, 3¼-in. x 4¼-in., Washington fir, when obtainable.

Wood Pins.—Locust pins are quoted at $59.94 per 1,000 in large lots and are in better supply than when last reported, although still not plentiful enough to fill requirements. Improved freight conditions should relieve this situation speedily.

Glass Insulators.—Insulators are hard to get, all jobbers reporting orders far in excess of supply. An advance of approximately 10 per cent is announced to be effective July 20.

Line Hardware.—Following recent sharp advances in price, demand is noticeably lighter. Receipts by jobbers show some improvements, but delivery is very uncertain.

Fans.—Cool weather has reduced retail sales materially. Exhaust fans, for which demand continues heavy, require from thirty to sixty days for delivery.

Heating Appliances.—Long-deferred shipments from factory are beginning to be received by jobbers and passed along to the retailer. With public demand below normal it appears that the threatened famine in percolators and toasters will not occur. Jobbers still have great quantities on order.

BOSTON

Business in jobbing circles holds up well, but in some localities a slight falling off is noted as compared with the past three or four weeks. Collections are tightening up a bit. Stocks are showing considerable improvement except as regards rigid conduit and motors. Deliveries on these are both long and irregular. Prices are holding fairly firm, although some cuts are noted in appliance sales. On close competition, wire is being moved at lower figures than last week. Labor in the textile field is beginning to be less dictatorial, as layoffs increase, and in the electrical industry conditions are somewhat more stable. Considerable non-employment is noted in the textile mills, and dullness also affects the leather industry. Building operations are still retarded by high prices, although imposing totals are accumulating on contracts let compared with previous years. As a rule, considerable improvement is reported in regard to deliveries after orders leave the factories.

Motors.—Deliveries of about thirty-eight weeks are being quoted on motors ranging from 1 hp. to 10 hp., with firm prices and bare stocks. The demand shows some recession, except in textile motors, the call for these being well sustained, with requirements well handled.

Rigid Conduit.—The demand far outstrips supply at present. A leading jobber reports a shortage in all sizes, but as a rule the smaller diameters are harder to obtain. Fittings are scarce and stocks are being quickly depleted.

Non-Metallic Flexible Conduit.—No complaint is heard as to short supply. Fair trade is moving stocks, with the ⅜-in. size bringing $33.50 per 1,000 ft. in 5,000-ft. lots, and the ½-in. size $38.50 per 1,000 ft. in 1,000-ft. lots.

Flexible Armored Conductor.—Prices are steady, with a current quotation of $110 per 1,000 ft. on No. 14, single-strip, in 1,000-ft. lots. A reasonably good supply is on hand in this territory.

Wire.—No. 14 rubber-covered wire sold last week at $11 per 1,000 ft. in 5,000-ft. lots, under sharp competition between Boston and outside jobbers. Bare copper wire is quoted on a 24-cent base and weatherproof, which is still short, notwithstanding brighter prospects for increased production, is on a 29-cent base.

Sockets.—Excellent stocks are reported, without serious differences among types. Slower building work, especially in residences, means slow sales compared with the potential absorbing power of the construction market.

Wooden Molding.—Some of this material is moving, and one jobber sold nearly his entire stock on a single order recently. Some local shortages were reported last week.

Ranges.—Buying continues at a healthy rate, notwithstanding the fact that few if any range campaigns are on at present. New development work continues, and increased manufacturing facilities are soon to be realized.

Lamps.—Present demands are being well handled. Production is being pushed against the fall trade, and so far the indication is that the demand will be covered satisfactorily, but without a large surplus.

Vacuum Cleaners.—Stocks are very good, despite active sales.

ATLANTA

The Sixth Federal Reserve district reports a new high-water mark for building permits for the month of May. The principal Southern cities show a total of 2,210 permits, valued at $6,600,000, an increase in value of $2,000,000 over those for the preceding month. It is freely predicted that building permits for June will overtop those of May by a large margin.

Labor conditions throughout the territory are reported as somewhat easier, with the exception of a number of strikes in New Orleans, the situation there having been complicated by a walkout of the street-railway employees last week. The local strike of the plumbers, tinners and painters, though still technically in effect, is not interfering with building activities in Atlanta.

Manufacturers report a slackening in the receipt of orders from jobbers, due probably to the placing of heavy orders in the early spring and the great difficulty that is experienced in making any promises for future shipments. The jobbing trade itself reports business brisk, little or no slackening in orders being reported, with the exception of the southernmost section of the state, where the crop outlook, because of the boll weevil, is very poor. The freight congestion caused by the railway clerks' strike is greatly lessened, and outgoing shipments are moving fairly satisfactorily. No price increases of moment were reported last week.

All lines of trade report collections tightening up considerably, and credit is being extended with a great deal more caution than has heretofore been the case.

Rigid Conduit.—Several large shipments of pipe have just been received in the territory, some of them being made in open gondola cars because of the shortage in the standard box cars. These shipments have served materially to ease the situation. Prices, galvanized, lots less than 2,500 lb., ½-in., $9.40; 1-in., $18.46; 1½-in. $29.87; 2-in., $40.18, per 100 ft.

Wire.—A large shipment of rubber-covered wire is expected daily and its receipt will serve to ease the stringency in No. 12 and No. 14. Weatherproof is still hard to obtain, stocks being badly broken and the demand continuing so brisk as to prevent the accumulation of any noticeable supplies.

Electrical Toys.—Jobbing salesmen are beginning to push this specialty and are urging dealers to place orders for Christmas trade in anticipation of the difficulty in supplying the demand.

Rectifiers.—The large number of automobiles throughout the rural districts has created a heavy demand, and jobbers report that good stocks and fair shipments are assisting in a brisk movement of this article. An increasing popularity is predicted in all the small centers where alternating current is available.

Washing Machines.—Jobbers report that washing machines continue to come through in good volume and that the demand not only continues to hold up well, but in many instances shows a healthy increase, due to the difficulty with the servant problem.

Pole-Line Hardware.—Stocks of pole-line hardware are badly depleted and shipments are not coming through so satisfactorily as could be wished. The demand continues very brisk and no stocks can be accumulated. Prices are: Cross-arm braces, lots of less than 100, $15.35 to $22.06 per 100, according to size; through bolts, ⅝ in. x 14 in., $29.63 per 100; guy clamps, two-bolt, 3-in., $21.55 per 100; anchor rods, ⅝ ft. x 8 ft., $107 per 100.

SEATTLE—PORTLAND

From week to week business conditions in the electrical industry show but little change in the Puget Sound district. Sales volumes from the jobbers' standpoint are light, but retailers are doing a fair counter business. It is believed no definite change in conditions either way will be noted before fall. Stocks are in the same condition as before and the freight situation has not changed materially. Prices, while fluctuating slightly, show no marked change.

Through the action of Secretary John B. Payne, of the Department of the Interior, Seattle will receive tonnage needed to bring fuel oil from California to avert the threatened shutdown of the Lake Union steam auxiliary to the municipal lighting plant. The car supply continues to be the big problem before lumber manufacturers of the Pacific Northwest, as at present the car supply is less than 50 per cent of requirements. A slight scarcity of farm labor is being felt, particularly in eastern Washington and Oregon. However, any shortage will very likely be averted by the surplus made available by the closing of lumber mills and logging camps during the summer shutdown.

Portland jobbers report business in general as rather slow, although reports from dealers in smaller cities over the state seem to indicate a reasonably good volume of sales at the present time. The recent increased price on all lines of household heating appliances is certain to have a downward effect on sales.

Electrical contractors report that business has been dull but that during the past two or three weeks it has been improving materially. Collections are poor and the credit situation is still tightening.

Pole-Line Material.—Demand for all classes of line material has decreased during the past several weeks. Apparently most of the maintenance work has been completed. With the exception of porcelain insulators, local stocks are in fair shape. Stocks of glass insulators are also fair. Cross-arms are obtainable, but demand is very heavy.

Lamps.—The exception to the stock situation in Seattle is the supply of lamps. Deliveries are good and available stocks far in excess of demand. Sales are light on account of the season. Residence lamps are moving well but industrials are slow.

SAN FRANCISCO

The number of big construction projects in all the Coast cities, and principally in San Francisco, is larger than it has been for some time, but smaller building is lessening, and there is no doubt that the usual summer lull is at hand. Money, however, is plentiful; labor is in demand and deliveries are better, so that any slight signs of pessimism are not justified by actual conditions. The town of Willows in the Sacramento Valley has been practically wiped out by a $2,000,000 fire, and this on top of a poor rice crop will deal the Sacramento Valley a heavy blow.

Automobile Accessories.—The former tendency of electrical dealers to stock heavily on automobile accessories has been reversed, until now virtually only one jobber carries a complete line of electrical and other automobile accessories in connection with his legitimate electrical jobbing business. Even such lines as spark plugs and spotlights have been cut out.

Ranges.—The recent advance of approximately 15 per cent, which brings the average cabinet style range to about $225 retail, will have comparatively little effect on whatever business is done. The price seems to be an altogether secondary consideration. A few scattered stocks are carried, but the cabinet type range is practically nonexistent on the Coast. A three months' delivery would be almost a rush order.

Wireless Apparatus.—Dealers who carry this line report heavy sales. Stocks are all good, except on wireless receivers.

Telephones.—The call for telephones is scattering, and no considerable efforts are being made to increase it because of the difficulty in factory deliveries. Large central-station jobs require more than a year for their completion. Cable is very scarce and is holding up stations in many districts. There is some call for interphones, but the competition comes among architects and not among dealers. Several inquiries from the United States transpacific possessions are reported, notably from the Philippines.

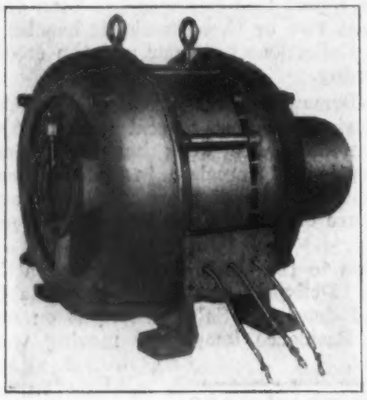
Sewing Machines.—After two months of dull business dealers and jobbers report that sales are again approaching normal.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Ball-Bearing Type Motor

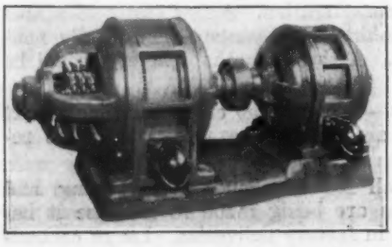
The Cleveland Electric Motor Company, Cleveland, Ohio, is marketing a type of riveted frame, ball-bearing, constant-speed, 25-cycle and 60-cycle, polyphase, squirrel-cage induction motor. Rotor bars are connected mechanically and electrically by a patented process in which the short-circuiting rings are welded around their ends. Ventilating fans are provided on the rotor. Standard ball bearings are used.



END RINGS ARE WELDED TO ROTOR BARS

Frequency Changer for High-Speed Induction Motors

A new application of the high-speed induction motor to certain classes of machine drive, especially in the woodworking and metal-trades industries, has been made possible by the development of an induction frequency changer by the General Electric Company. This device generates power at frequencies which will produce speeds of 18,000 r.p.m. or higher, says the manufacturer, and as a result high-speed induction motors can be directly applied to various types of machines.



SPEEDS UP TO 18,000 R.P.M. MAY BE OBTAINED

The frequency changer consists of a slip ring induction motor, which may be driven either by a belt or directly, the stator being connected to an alternating-current source of power. By rotating the machine in a direction opposite to that in which it would run as a motor frequencies are generated in the rotor equal to that of the exciting circuit plus that due to the reversed rotation of the rotor.

Virtually all the energy taken from the commercial circuit is transformed into high-frequency energy to drive the machine motors, it is claimed, the over-all efficiency being approximately 90 per cent. Where direct-current power only is available, an inverted rotary converter can be used both as a motor to drive the frequency changer and to supply the excitation for the stator. The high frequency supplied by this device being always three-phase insures uniformity as well as economy and simplifies both the motors and the frequency changers.

The standard motors are two-pole and wound in two series, the first rated normally at 120 cycles, 220 volts, the second at 200 cycles, 110 volts, to operate at a range of from 200 cycles to 300 cycles. The operating voltage of the motors must vary in proportion to the speed and frequency, but this change is accomplished automatically by the frequency changer. The normal slip is from 5 to 7 per cent, but where the load is such that the starting torque is the factor in determining the size of the motor it can be increased by increasing the slip to 8 or 10 per cent, although such changes are objectionable if the motor must carry full load.

Notes on Recent Appliances

Storage Battery

The Dixie Storage Battery Company, 1418 West Lafayette Avenue, Baltimore, Md., is manufacturing a storage battery designed especially for automobile starting and lighting service.

Time Switch

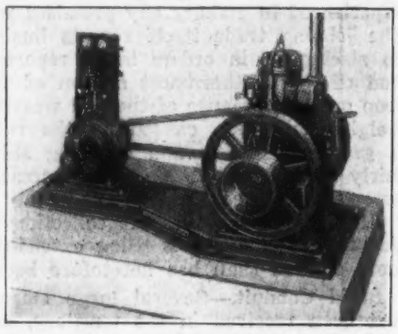
A low-voltage electrically wound time switch, type S, is being marketed by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass.

Electric Furnace

The Greene Electric Furnace Company, 1602 Hoge Building, Seattle, Wash., has placed on the market a cylindrical electric furnace for making iron and steel.

Belt-Driven Electric Farm-Lighting Plant

Both electrical and mechanical energy may be obtained from the belt-driven farm-lighting plant now being marketed by the Chambers Manufacturing Company of Butler, Pa. The 4-hp. engine has two pulleys—one for driving the electric generator and the other for furnishing mechanical power. The engine may be operated with gasoline, kerosene, crude oil or natural gas. The generator is a 40-volt, 1-kw. shunt-wound Westinghouse machine, and the unit is controlled by a Westinghouse panel, on which are mounted a voltmeter, an ammeter, a rheostat, fused line switch, series field switch, ignition switch and a reverse current relay. A 16-cell, 107-amp.-hr. battery is used.



MECHANICAL AND ELECTRICAL POWER BOTH ARE DELIVERED

Twenty-Ampere Heavy-Duty Receptacle

A plug and receptacle has been developed by the Benjamin Electric Manufacturing Company, Chicago, for use with portable electrical devices requiring approximately 20 amp. on 125-volt circuits, though primarily designed for use in connection with 32-volt farm-lighting plants. The receptacle is so designed that it will take either the 20-amp. heavy-duty plug or the standard 10-amp. parallel blade cap. The receptacle contains double-spring contacts, so that electrical contact is made on both sides of the cap blades. The cap can be easily disconnected from the receptacle even when pulled at an angle. The receptacles are made for both flush and surface mounting.

RECEPTACLE TAKES BOTH 10-AMP. AND 20-AMP. PLUG

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

R. T. ROTH, of Philadelphia, Pa., has recently become associated with Schweitzer & Conrad, Inc., as sales manager, with headquarters in Chicago. Mr. Roth was for a number of years connected with the Western Electric Company at the Philadelphia office. In 1910 he left the company to organize the Lewis & Roth Corporation, Philadelphia, construction engineers and manufacturers of high-tension equipment, with which he has been actively connected for the last ten years. He recently disposed of his interests in the Lewis & Roth Corporation. Mr. Roth's experience in the purchase and sale of electrical equipment has covered a period of twenty years.

J. A. WIDMER, formerly experimental engineer with the Sperry Gyroscope Company, has accepted a position with the Square D Company, Detroit, Mich., as development engineer.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has awarded contract for construction of a one and two-story machine shop, 230 ft. x 900 ft., at Erie, Pa. The total cost is estimated at about $1,000,000.

THE MIDSTATES ENGINEERING COMPANY, Westminster Building, Chicago, has recently been incorporated as consultants, specializing in industrial power and plant engineering. The equipment and commercial division activities will be directed by J. H. Milliken, who is known in this field as an industrial sales manager. The engineering work will be in charge of R. J. Gaudy, president, who is known through activities with the Sessions Engineering Company and his connection with many engineering projects.

HAROLD L. HAZELTINE, formerly instructor of physics and electricity at the Trenton (N. J.) School of Industrial Arts, has become Eastern representative of the Sterling Varnish Company. He will make his headquarters in the New York district after Sept. 15.

THE COVINGTON MACHINE COMPANY, Inc., Covington, Va., has taken over the business of the Covington Machine Company and will continue the manufacture of punches, coke drawing and conveying machinery, etc., as well as making brass and iron castings. The officers of the new company are: F. U. Humbert, president and general manager; F. W. King, vice-president, and G. W. Lipscomb, treasurer.

THE NATIONAL ELECTRICAL CREDIT ASSOCIATION at its twenty-first annual convention in New York City, June 17 and 18, considered the advisability of raising and spending $25,000 to promote the sale and installation of the standard accounting system sold by the National Association of Electrical Contractors and Dealers. A committee has been appointed to confer with a similar committee of the contractors and dealers' association.

THE KINGSBURY-SAMUEL ELECTRIC COMPANY, 213 North Calvert Street, Baltimore, Md., has acquired a three-story building, 26 ft. x 110 ft., at 530-532 North Calvert Street, which it will equip for the manufacture of electrical products.

THE GIANT BATTERY COMPANY, Commercial Bank Building, Houston, Tex., recently incorporated, will establish a plant at once for the manufacture of electric storage batteries, separators and other parts. C. C. Rouse is president.

THE NEW ENGLAND WELDING COMPANY, Boston, Mass., recently incorporated as a subsidiary to the Thomson Electric Welding Company, Lynn, Mass., will locate in Worcester, Mass., and specialize in heavy steel and cast-iron sections.

NORTH CENTRAL ELECTRIC ASSOCIATION, at its first convention held recently at Minneapolis, Minn., elected the following officers for the coming year: C. D. Crocker, president; O. A. Rofelty, vice-president; H. E. Young, secretary, and Fred C. Hoffman, treasurer.

CLYDE L. CORBIN, district manager for the National Metal Molding Company in Pittsburgh territory, was seriously injured on June 15, sustaining a fractured skull and other injuries. He is now convalescing at the Mercy Hospital in Pittsburgh.

THE GREGORY ELECTRIC COMPANY, Chicago, at a meeting of its stockholders on July 1, authorized an increase in capital stock to $1,000,000. The present capital stock is $241,600.

THE WESTERN ELECTRIC COMPANY has recently added a large wing to its factory in Emeryville, Cal., in order to take care of the increasing business that has been built up on the West Coast. This branch will be devoted almost exclusively to the handling of automatic telephones, sales of which are increasing in that section of the country.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, announces the appointment of George D. Luther as soliciting agent in Seattle, Wash., with offices at 811 White Building. Mr. Luther joined the sales force of the Boston office of the company in 1907, and in 1910 he was made soliciting agent in Denver, in which capacity he served until his recent appointment.

G. V. NIGHTINGALE, formerly Western sales manager for the Wilson-Maeulen Company, manufacturers of electric pyrometers, and F. C. Baker, formerly district manager of the same company, in Chicago, have formed a partnership under the name Nightingale & Baker, with offices at 163 West Washington Street, Chicago. They will represent the Wilson-Maeulen Company as general agents in all territory west and southwest of Ohio and Michigan.

THE COXE STOKER SALES COMPANY announces the appointment of Christian Schillinger, formerly engineer of steam equipment for the Delaware, Lackawanna & Western Railroad Company, as sales engineer, effective June 1.

THE APEX ELECTRICAL DISTRIBUTING COMPANY, Cleveland, Ohio, has established a new office in the Candler Annex Building, Atlanta, Ga., in charge of F. W. Price, Southern district manager. The company handles the Apex electric suction cleaners.

THE HIGHLAND MANUFACTURING COMPANY, Muncie, Ind., manufacturer of electric and gas fixtures and electric novelties, will rebuild its plant, which was destroyed by fire on June 29. The loss is estimated at about $200,000. Thomas L. Ryan is president and manager.

THE VESTA STORAGE BATTERY COMPANY, 1696 Broadway, New York City, manufacturer of storage batteries, has leased two buildings at 47-49 West Sixty-third Street for its proposed new works.

THE WADDELL ELECTRIC COMPANY, Atlanta, Ga., state distributer of farm-lighting plants manufactured by the Western Electric Company, held a convention on May 17 and 18, at the Piedmont Hotel, which was attended by its entire sales organization, comprising about forty men.

L. G. WHITE has severed his connection as manager and buyer of the electrical department of G. Sommers & Company, St. Paul, Minn., to accept a position with the Modern Laundry Machine Company, Kansas City, Mo.

J. H. WILLIAMS & COMPANY, Brooklyn, N. Y., announce that the drop-forge business and plants of the Whitman & Barnes Company at Chicago, Ill., and St. Catharines, Ontario, Can., have been combined with and are operated by that company. The organization includes the individuals heretofore identified with both concerns.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has purchased a site (approximately 400 ft. square) at Humphries Street and Glenn Avenue, Atlanta, Ga., on which it proposes to erect a storehouse.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, announces the opening of a sales office and service station at No. 2007 South Ervay Street, Dallas, Tex., in charge of Charles O. Rauschkolb, branch manager.

Supply Jobbers' Notes

THE WESTERN ELECTRIC COMPANY, 195 Broadway, New York City, held its annual sales conferences of the Atlanta (Ga.) district on Tybee Island on June 29. An attendance of between 75 and 100 employees is reported, including salesmen from the Atlanta territory, factory representatives and representatives from the home office.

THE COMMERCIAL ELECTRICAL SUPPLY COMPANY, Broadway and Spruce Street, St. Louis, Mo., has recently opened a specialty department and has employed several additional salesmen.

CREDIT ASSOCIATION CONSIDERS SPENDING $25,000 TO PROMOTE BETTER ACCOUNTING

Foreign Trade Notes

THE ETERNAL BATTERY COMPANY OF CANADA, LTD., recently organized to take over the property and business of the Eternal Battery Company, Winnipeg, Manitoba, Can., has acquired a site of about two acres at the corner of Main Street and Toronto Avenue, Kildonan, on which it proposes to erect a plant. Charles W. Jenner is president.

W. R. HAMILTON is manager and engineer of the Dominion Messenger Signal Company, Ltd., 302 St. James Street, Montreal, Quebec, Can., which recently absorbed the Dominion Gresham Guaranty & Casualty Company's electrical department.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY has made the following appointments: At East Pittsburgh H. F. Griffith is assistant to general manager, R. W. Everson is manager of merchandising department, and H. C. Soule is manager of apparatus department. In New York G. H. Bucher is assistant to general manager, J. H. Payne is supervisor of agencies, and F. M. Sammis is manager of incandescent-lamp department.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Tenders will be received at the office of the power commissioner of a city in Canada (No. 33,244) for fuel-oil engines and generators with switching equipment for an electric plant.

A merchant in France (No. 33,216) desires to purchase electrical goods and electrical specialties of all kinds.

A manufacturer's agent in Australia (No. 33,198) desires to secure an agency for the sale of all kinds of supplies and wire for electric household and office appliances, also mica and general electrical supply lines.

An agency is desired by a merchant in Switzerland (No. 33,203) for the sale of telephone equipment, electrical specialties, etc.

A commercial agent in Switzerland (No. 33,206) desires to secure the representation of firms for the sale of electrical supplies, etc.

Consulting engineers in Java (No. 33,225) desire to purchase water-power installations and machinery; one installation of 100,000 hp. and several others of 2,000 hp., cableways, etc.

A company in Venezuela (No. 33,231) desires to purchase machinery and equipment, excepting poles, for the installation of an electric light plant to maintain from 800 to 900 incandescent lamps of 25 cp. each, to be installed in two towns in that country.

Trade Publications

IGNITION.—The Remy Electric Company, Chicago, has issued four booklets covering its ignition systems for motor cars, tractors, etc.

GRINDERS.—Charles H. Besly & Company, 118-124 North Clinton Street, Chicago, is circulating a large catalog covering the "Besley" grinders and accessories.

ELECTRIC HAMMERS.—Bulletin No. 4 issued by the American Electric Tool Company, Petersburg, Va., describes and illustrates the Paulero electric hammer, type A, form 1, and generating outfits for use in monument and stone-cutting industries.

ELECTRIC HOISTS.—The Northern Engineering Works, Detroit, Mich., have issued catalog No. 43, covering their type D electric hoists.

INTER-PLANT TRANSPORTATION.—The Automatic Transportation Company, Buffalo, N. Y., has issued a fifty-four-page illustrated booklet covering its automatic electric industrial trucks, tractors and engines for inter-plant transportation.

HIGH-TENSION MAGNETO SYSTEMS.—The Simms Magneto Company, East Orange, N. J., is circulating catalogs Nos. 15 and 22, describing its high-tension magneto systems, and catalog No. 24, covering Simms-Huff starting and lighting systems.

New Incorporations

HILDRETH, CASEY & COMPANY, New York City, has been incorporated by J. C. Hildreth, H. H. Casey and W. Steinauer, 573 East 136th Street, New York, to manufacture machinery, electrical equipment, etc.

THE PROTECTO BATTERY FILLER COMPANY, 3 South Walnut Street, East Orange, N. J., has been incorporated by Louis M. Sanders and Louis M. Sanders, Jr. The company is capitalized at $600,000 and proposes to manufacture battery equipment, automobile parts, etc.

THE AMSTERDAM LIGHTING FIXTURE & NOVELTY COMPANY, New York City, has been incorporated by S. L. Klein and H. Litwin, 2346 Eighty-fifth Street, Brooklyn, N. Y. The company is capitalized at $50,000 and and proposes to manufacture metallic lighting fixtures and kindred products.

THE BRILLIANT CHANDELIER MANUFACTURING COMPANY, New York City, has been incorporated with a capital stock of $50,000 to manufacture gas and electric fixtures. The incorporators are M. Brilliant, A. Drutman and M. Propp, 122 West 114th Street, New York City.

THE OLNEYVILLE WELDING COMPANY, Webster Avenue and Plainfield Street, Providence, R. I., has been organized by Rudolph Csizmesia, 82 Dorchester Avenue, Providence, and others, to manufacture welding equipment.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CLINTON, MASS.—Authority has been granted to the New England Power Company to erect wire on Lawrence Street for the transmission of electricity.

DANVERS, MASS.—The erection of a new power plant at the State Hospital to cost about $250,000 is contemplated. The R. G. Kimball Company, 6 Beacon Street, Boston, are engineers.

FALL RIVER, MASS.—The committee on street lights has approved an order for improvements and extensions to the street-lighting system.

QUINCY, MASS.—The Bethlehem Shipbuilding Corporation will require considerable electrical equipment to be used in a combination shop to be constructed at its Fore River yard at a cost of about $150,000.

HARTFORD, CONN.—The installation of a Gamewell fire alarm system is planned for the new plant of the Hartford Rubber Company now under construction.

HARTFORD, CONN.—The Hartford Fire Insurance Company has had plans prepared for the construction of a power plant on Asylum Avenue, to cost about $150,000.

Middle Atlantic States

BUFFALO, N. Y.—Contract has been awarded to J. W. Cowper Company, Fidelity Building, by the Standard Oil Company for the erection of a new power plant at its Atlas works on Elk Street, to cost about $250,000.

CARMEL, N. Y.—A franchise has been granted by the borough officials of Carmel and Kent, Putnam County, to Ellsworth Fowler, who will head a new company to be organized for the purpose of erecting an electric power plant.

ENDICOTT, N. Y.—Work is under way on the construction of three additional factory buildings, Nos. 17, 18, and 19, for the International Time Recording Company. An extension to the power plant will be erected. The cost is estimated at about $450,000.

FREEPORT, N. Y.—At a special election it was voted to raise $63,000 for improvements to the village lighting system, including the purchase and installation of engine and generator equipment, increasing the capacity of the electric light plant by 250 kw.

LONG ISLAND CITY, N. Y.—Electrical equipment, including telephone system, electric time clock service, motors, electrical controlling devices, etc., will be installed in the new printing plant to be constructed for the Metropolitan Insurance Company, New York City.

OLEAN, N. Y.—The construction of a new power and boiler plant at the local high school to cost about $50,000 has been planned for by the Board of Education.

SARANAC LAKE, N. Y.—Petition has been made to the Public Service Commission by the Paul Smith's Electric Light, Power & Railroad Company for permission to issue $100,000 to provide part payment for proposed construction to cost about $200,000.

SYRACUSE, N. Y.—The proposed $20,000,000 merger of electric power companies includes the Adirondack Power Company, Mohawk Electric Company, Utica Gas & Electric Company, Schenectady Power Company and the East Creek Light & Power Company. Plans, it is understood, will include the erection of a large modern steam generating electric power plant, rebuilding the East Creek plant and the erection of a power line from Spiers Falls.

UNION, N. Y.—The village officials contemplate the erection of a new electric distribution station on a recently acquired site. The old plant will be dismantled and the building and machinery will be sold.

WALLKILL, N. Y.—The Public Service Commission has granted permission to the Wallkill Valley Electric Company for the construction of additions to its power plants at Wallkill and Montgomery.

ESSEX FELLS, N. J.—Ordinances have been adopted by the Borough Council providing for the purchase of the local waterworks system, including electrically operated pumping plants, etc., for $175,000. It is understood that improvements and extensions will be made.

MAYS LANDING, N. J.—Notice of increase in its capital stock from $250,000 to $750,000 has been filed by the Mays Landing Water Power Company for proposed extensions.

NEWARK, N. J.—Bids will be received at the office of William J. Brennan, director of Public Safety, City Hall, until July 22, for furnishing the Police Division of the Department of Public Safety with the following cable for the police signal system: 2,000 ft., more or less, No. 18 gage ten-pair twisted-copper rubber-insulated lead-sheath underground cable and 1,000 ft., more or less, No. 18 gage five-pair twisted-copper rubber-insulated lead-sheath underground cable.

NEWARK, N. J.—Contract has been awarded to the United Fireproofing Company, 8 West Fortieth Street, New York, N. Y., for the erection of a factory and power house for the Peerless Baking Company, 713 South Fourteenth Street, Newark. Power house equipment will be required.

NEWARK, N. J.—Bids will soon be received by the Osborne Company, 759 Summer Avenue, for the erection of a power house to cost about $50,000. Equipment includes two 150-hp. boilers, engine and generator.

POMPTON LAKES, N. J.—The installation of an electrically operated fire alarm system has been approved by the Borough Council.

SUMMIT, N. J.—Bids will be received by Frederick C. Kentz, city clerk, until July 20 for furnishing two 2,000,000-gal centrifugal sewage pumps with motors and one 1,000,000-gal. centrifugal sewage pump with motor. Specifications and blank proposals may be obtained on application to the city engineer.

ALTOONA, PA. — Enlargement of its plant to cost about $1,000,000 is being planned by the Standard Power Company.

DONORA, PA. — The American Steel & Wire Company contemplates the erection of an ore dock and an unloading dock for coal. Electrically operated hoisting, conveying and material-handling machinery will be installed.

EASTON, PA.—Plans are under way for the construction of an addition, 30 ft. x 85 ft., to the power plant of the Pennsylvania Utilities Company at Second and Ferry Streets. The Public Service Commission has granted the company permission to issue $49,500 in bonds.

PHILADELPHIA, PA. — Application has been made to the State Public Service Commission by the Philadelphia Suburban Gas & Electric Company to issue $827,000 in stocks and bonds for proposed extensions and betterments.

PHILADELPHIA, PA.—Plans have been filed for extensions and improvements to the power house at the dye works of D. F. Waters, 53 Wister Street, to cost about $25,000.

PHILADELPHIA, PA. — Extensions and improvements to its power plant is contemplated by Foss-Hughes Company, Twenty-first and Market Streets.

PITTSBURGH, PA.—Arrangements have been made by the Penn Public Service Company, operating in Johnstown, Somerset, Phillipsburg and vicinity, for a bond issue of $850,000 for proposed extensions and improvements.

BALTIMORE, MD.—The Steinmetz Electric Motor Car Company, Inc., has acquired the newly erected plant of the Reus Brothers Company, Western Maryland Railroad and Kate Avenue. The present building, 100 ft. x 240 ft. will be enlarged and other buildings of similar construction will be added.

FREDERICK, MD.—The Board of Aldermen is planning for the establishment of a municipal electric power plant with improved distribution service. C. L. Reeder, 200 West Saratoga Street, Baltimore, is electrical engineer.

FREDERICK, MD.—The installation of a power and heating plant to cost about $25,000 at the Maryland School for the Deaf is contemplated.

MT. AIRY, MD.—The Hagerstown & Frederick Railway contemplates the erection of a local substation and a 16-mile, 33,000-volt electric transmission line.

UPPER MARLBORO, MD.—The installation of a local electric system for street lighting and commercial service is under consideration by the borough officials.

WASHINGTON, D. C.—Bids will soon be received by the District Commissioners for the construction of the psychopathic ward of the proposed new Gallinger Hospital to cost about $1,500,000, including a central power plant to be installed later.

North Central States

HAMTRAMCK, MICH.—The construction of a power house, 80 ft. x 83 ft., is contemplated by the Briggs Manufacturing Company.

LANSING, MICH.—On July 23 a special election will be held for the purpose of submitting to the voters a proposition to issue $145,000 in bonds for improvements to the electric light and power plant.

MOUNT PLEASANT, MICH.—A sum of $30,000 has been appropriated for the installation of a new power and heating plant in the Indian School at Mount Pleasant.

ST. CLAIR, MICH.—Plans are under way for improvements to the waterworks system, to include furnishing and installing one 300-hp. engine, one 200-kva. direct-connected generator, etc.

CANTON, OHIO.—Plans are under way for the construction of a power plant for the Hoover Suction Sweeper Company of North Canton.

CLEVELAND, OHIO.—Plans are under way by Walker & Weeks, architects, 1900 Euclid Avenue, for the construction of a bank and office building to cost about $500,000 for the Citizens' Savings & Trust Company, Alvord Smith vice-president, East Ninth Street and Euclid Avenue. Electric light equipment and electric elevators will be installed.

INDIANAPOLIS, IND. — Authority has been granted to the Linn Grove Light & Power Company to sell $25,000 in bonds for improvements.

BLUE ISLAND, ILL.—Plans have been outlined by the Chamber of Commerce for the installation of a modern boulevard lighting system.

CENTRALIA, ILL.—Contract has been awarded to Joseph E. Nelson & Sons, 3240 South Michigan Boulevard, Chicago, by the Illinois Central Railroad Company for the construction of a passenger station, freight house, power house, etc., at Centralia, to cost about $400,000.

MADISON, WIS.—The construction of a hydro-electric plant, 46 ft. x 50 ft., is contemplated by the Peninsular Power Company.

OCONTO, WIS.—The Holt Lumber Company is planning for the construction of a power plant to cost about $75,000.

NORCROSS, MINN. — Bonds to the amount of $6,000 have been voted for furnishing better electric light facilities.

KANSAS CITY, MO.—The Kansas City Light & Power Company will spend approximately $500,000 during the next two years on the installation of five new substations in the down-town district between Oak and Wyandotte Streets and Seventh and Fifteenth Streets. The big substation at Fifteenth and Walnut Streets is to be abandoned as facilities under the new substation scheme develop. The stations will be equipped with automatic generator sets for converting alternating current to direct current. The first substation will be located in the R. A. Long Building on Tenth and Grand Avenues, and equipment will include one standard 1,500-kw. rotary. The company has purchased a 2,500-kw. rotary.

ROLETTE, N. D.—The Rolette Mill & Light Company plans the erection of a flour mill and lighting plant to cost about $15,000.

DUPREE, S. D.—The installation of electric lights throughout the city is contemplated by the Dupree Light & Power Company. Hugh Walkup is secretary.

TYNDALL, S. D.—A proposition to issue $50,000 in bonds will be submitted to the voters for the purpose of repairing the local electric light plant.

DE WITT, NEB.—John Zwonechek and Joseph Aksamit have purchased the property of the De Witt Milling Company on the Blue River and plan to erect a hydro-electric plant at a cost of about $100,000. It is understood that the owners will furnish energy for the milling company and may also extend a line from De Witt to Western, Catonia and other points.

LAWRENCE, KAN. — Improvements to the power and heating plant at the Indian School, Haskell Institute, to cost about $20,000, are contemplated.

Southern States

LAKE WORTH, FLA.—The city officials plan extensions and improvements to the light and water plants at a cost of about $15,000.

SMITHVILLE, TENN. — Bonds to the amount of $30,000 have been voted for the erection of an electric transmission line from the Great Falls Power Company's plant at Rock Island to Smithville.

FLORENCE, ALA.—The Burcham Valley Telephone Company, recently organized, contemplates installing a system in various parts of Lauderdale County.

MONROEVILLE, ALA.—A movement to establish a municipal electric light and power plant is being promoted by the Chamber of Commerce.

PRATTVILLE, ALA. — The installation of electrical equipment is contemplated by the Autauga Cotton Mills.

JONESVILLE, LA.—The construction of an electric light and water plant is contemplated. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

CLAREMORE, OKLA.—An issue of $75,000 in bonds was approved for extension to the electric light system in Claremore.

DALLAS, TEX. — The Dallas Light & Power Company has been requested to place its wire under ground.

KOUNTZE, TEX. — J. R. Bevil and others plan to construct an electric light plant, waterworks and ice factory.

WACO, TEX.—The Central Texas Electric Railway Company has made preliminary investigation of the proposition to erect a line from Waco via Mexia to Palestine, a distance of about 105 miles.

Pacific and Mountain States

SEATTLE, WASH. — Contract has been awarded to the Hurley-Mason Company for the completion of the third unit to the Lake Union steam plant, to cost about $200,000.

KLAMATH FALLS, ORE.—The Oregon-California Power Company contemplates immediately disposal of $1,842,000 for improvements.

BRAWLEY, CAL. — Earl S. Casey of Brawley is negotiating with the City Council for the construction of a hydro-electric power plant on the Alamo River, to cost about $200,000. Three turbine and generating units, with auxiliary operating machinery, will be installed.

SAN FRANCISCO, CAL. — An expenditure of about $22,500,000 will be made by the Southern Pacific Railway for equipping steam and electric railroads.

SIERRA CITY, CAL.—Surveys are being made for a series of large storage dams in the North Yuba River between Sierra City and Indian Valley, to be used for power purposes by the Yuba Development Company.

WIDSTOE, UTAH.—Reconstruction of the Hatchtown Dam to impound 6,000 acre-ft. of water and the construction of canals to bring the water to the present holdings of the Johns Valley Irrigation Company is contemplated, at a cost of about $120,000. Elmer Jorgensen is president.

GLENDALE, ARIZ.—A. A. Carrick and Frank Mongham have been authorized to erect a power plant and pumps for irrigation purposes in Avondale-Buckeye district.

ROOSEVELT, ARIZ. — According to terms of contract the Gila Cotton Company will furnish the Salt River Valley Water Users' Association with $500,000 for the construction and complete equipment of a 5,000-kw. auxiliary electric generating plant at Roosevelt Dam, and the Water Users' Association will furnish power at a stipulated price for the operation of pumping plants to be erected by the Cotton Company on the Gila Indian Reservation for irrigation purposes. Also the Auxiliary Eastern Canal Land Owners' Association has been authorized to divert waste water of the Salt River Valley project to be pumped into the Eastern Canal from Granite Reef and then into the canals of the Auxiliary Association.

POLSON, MONT. — Application for preliminary power permit has been filed by the Rocky Mountain Power Company of Butte, in the office of the federal register of lands. Plans include the construction of five dams in Flathead River between the northeast corner of Bison Range and the point where the river leaves the lake near Polson.

ROMAN, MONT. — Permission has been granted by the town officials for the development of electricity for light, heat and power purposes in Crow Creek Canyon.

OSAGE, WYO.—The Osage Light Company has been recently incorporated for the purpose of erecting an electric light plant in Osage to cost about $12,500.

Canada

ALICE ARM, B. C.—W. V. Hunt, 1652 Eighth Avenue West, has been awarded general contract by the Dolly Varden Mining Company for the erection of a hydro-electric plant to cost about $65,000.

CHATHAM, ONT.—Plans are under way for alterations to pumphouse including the installation of mechanical filters and electrically driven centrifugal pumps, to cost about $50,000. E. A. James Company, 36 Toronto Street, Toronto, are engineers.

HAMILTON, ONT.—Bonds to the amount of $15,000 have been voted for the construction of an electric light plant in Hamilton.

OTTAWA, ONT.—Bids will soon be received by Stevens & Lee, architects, 62 Charles Street, East Toronto, for the construction of a hospital to cost about $1,500,000. Electric elevators and electrical equipment will be installed.

SPRING BANK, ONT.—Bids will soon be received by the Utilities Commissioners of London for the construction of a dam at Spring Bank for power purposes. The cost of the project is estimated at about $300,000, including $100,000 for equipment. E. V. Buchanan is general manager.

MONTREAL, QUE. — General contract has been awarded to John McGregor, 511 St. Catherine Street, by the Canadian Steel Foundries, 120 St. James Street, for the erection of a power house.

MOOSE JAW, SASK.—T. W. Graham has been awarded general contract by the Canadian Pacific Railway Company for the erection of a power house to cost about $35,000.

(Issued June 22, 1920.)

14,888 (reissue). INSULATOR; Walter T. Goddard, Hamilton, Ont., Can. App. filed July 22, 1919. Exterior meeting faces of sections form unobstructed surface without acute change in direction.

14,891 (reissue). HIGH-VOLTAGE TRANSFORMER; Svend E. Johannesen, Pittsfield, Mass. App. filed April 20, 1920. Efficacious manner of constructing, mounting and ventilating.

14,896 (reissue). HIGH-TENSION DISCHARGE APPARATUS; George D. Rogers, Cleveland, Ohio. App. filed April 7, 1914. For therapeutic use on lamp socket.

1,344,042. SPARK-GAP INDICATOR; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed Aug. 16, 1919. Detects incipient defect of insulator in service.

1,344,210. AUTOMATIC TELEPHONE REPEATER; Rodney G. Richardson, Chicago, Ill. App. filed Aug. 23, 1916. For multi-office automatic system.

1,344,220. ELECTROLYTIC APPARATUS; Edward O. Benjamin, Newark, N. J. App. filed Aug. 1, 1917. For producing pure oxygen gas and hydrogen.

14,888 (Reissue). Insulator

1,344,222. ELECTRIC REGULATOR; John L. Creveling, White Plains, N. Y. App. filed Nov. 1, 1916. For battery charging.

1,344,260. METHOD AND MEANS FOR CONTROLLING ELECTRIC CIRCUITS; Harry R. Canfield, Cleveland, Ohio. App. filed Sept. 21, 1910. For starting motors.

1,344,275. METHOD OF AND APPARATUS FOR ELECTRICAL COMMUNICATION; David G. McCaa, Elizabeth, N. J. App. filed Dec. 19, 1918. Eliminates interference on high-frequency system.

1,344,282. ELECTRIC HEATING ELEMENT; Clifford R. Wassell, Chicago, Ill. App. filed May 5, 1916. Carrying member of refractory insulating material.

1,344,303. ELECTRIC VAPOR HEATER FOR INTERNAL-COMBUSTION ENGINES; William F. Little, St. Louis, Mo. App. filed Jan. 23, 1919. Located between manifold and carburetor.

1,344,387. INTERNAL-COMBUSTION-ENGINE-TESTING DEVICE; Roy G. Edgerton, Suffolk, Va. App. filed May 26, 1916. Tests spark of cylinder.

1,344,388. COMBINATION MAGNETIC AND ELECTRIC POLARITY INDICATOR; Carl W. Eisenmann, Nebraska City, Neb. App. filed Aug. 16, 1919. Auxiliary compass pointer shows current direction.

1,344,406. ELECTRICAL RESISTANCE WIRE; Albert H. Johnson, Washington, D. C. App. filed Dec. 19, 1919. Wire flattened to prevent misalignment.

1,344,415. ELECTRIC WELDING APPARATUS; Frederick V. D. Longacre, Yonkers, N. Y. App. filed July 25, 1918. For lap-welding plates.

1,344,429. ELECTRIC LAMP; George E. Ricker, Fitzgerald, Ga. App. filed Jan. 14, 1918. Reflector within bulb.

1,344,452. ELECTROLIER; Louis Roth, New York, N. Y. App. filed June 27, 1919. Globe easily detached.

1,344,463. ELECTRICAL SYSTEM; Richard Varley, Englewood, N. J. App. filed April 26, 1919. For internal-combustion engine.

1,344,528. INTENSIFIER; Harry R. Walker, Galatia, Ill. App. filed Aug. 23, 1919. For increasing strength of spark.

1,344,581. THERMO-ELECTRIC ARCH SUPPORT; Albert H. Cooper, Findlay, Ohio. App. filed Aug. 22, 1919. Heated arch supporter.

(Issued June 29, 1920)

1,344,654. DIRECTION INDICATOR FOR VEHICLES; William F. Rotermund, Seattle, Wash. App. filed Jan. 31, 1918. Revolubly mounted indicating hand.

Record of Electrical Patents

Notes on United States Patents

1,344,681. PROCESS OF EXTRACTING METALS; Charles J. A. Dalziel, London, England. App. filed Jan. 17, 1920. Metal precipitated from ore in single operation.

1,344,699. RELAY; Richard C. Leake, Rochester, N. Y. App. filed April 25, 1918. Railway signaling.

1,344,701. AUTOMATIC FIRE ALARM; William J. Luse, New York, N. Y. App. filed Nov. 20, 1918. By disruption of fusible link.

1,344,713. REACTANCE COIL; John F. Peters, Edgewood Park, Pa. App. filed Dec. 2, 1915. Power-limiting device.

1,344,723. MAGNETO; Wolfgang E. Schwarzmann, Springfield, Mass. App. filed Oct. 12, 1918. Sleeve type.

1,344,730. RELAY; Benjamin H. Smith, Turtle Creek, Pa. App. filed Jan. 29, 1917. Reverse-phase relay.

1,344,741. ELECTRIC SADIRON; Frank Thornton, Jr., Pittsburgh, Pa. App. filed Oct. 3, 1914. Heat insulating heel.

1,344,742. ELECTRICAL COMPENSATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed May Aug. 9, 1916. Voltage regulator.

1,344,743. ELECTRICAL COMPENSATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed May 28, 1919. Voltage regulator.

1,344,752. ELECTROLYTIC CELL; Lewis W. Chubb, Edgewood Park, Pa. App. filed Feb. 3, 1917. Titanium arrester.

1,344,753. ELECTROLYTIC CELL; Lewis W. Chubb, Pittsburgh, Pa. App. filed Feb. 3, 1917. Titanium oxide arrester.

1,344,757. ARC LAMP; William A. Darrah, Wilkinsburg, Pa. App. filed June 11, 1915. Incandescent vapor lamp.

1,344,759. ELECTRICAL PROTECTIVE DEVICE; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed April 4, 1918. Dissipates electromagnetic energy of field-magnet winding.

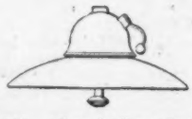
1,344,762. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 10, 1914. Electric railway.

1,344,812. MEANS FOR CHARGING STORAGE BATTERIES; Clarence E. Ogden, Cincinnati, Ohio. App. filed Nov. 14, 1918. Used on commercial trucks, locomotives, etc.

1,344,814. POWER PLANT; Raymond H. Olley, Syracuse, N. Y. App. filed July 25, 1917. Wide range of speed without gear shifting.

1,344,822. SELECTIVE SWITCHING MECHANISM; Rodney G. Richardson, Chicago, Ill. App. filed May 10, 1916. Automatic telephone.

1,344,869. ELECTROLYZING COBALT SOLUTIONS; Elisha B. Cutten, Kokomo, Ind. App. filed Oct. 20, 1919. Neutral solution employed as electrolyte.



1,344,042. Spark-Gap Indicator

1,344,870. ENGINE-STARTING SYSTEM; James K. Delano, New York, N. Y. App. filed Dec. 9, 1916. For automobiles.

1,344,918. COMBINED TELEPHONE AND PHONOGRAPH; John F. Malthaner, Atlanta, Ga. App. filed July 12, 1917. To record telephonic conversations on dictaphone.

1,344,938. ARC-LAMP CASING; Iredell Eachus, Philadelphia, Pa. App. filed April 28, 1916. Draft draws dust from operating mechanism.

1,344,970. RELAY FOR STORAGE-BATTERY-CHARGING SYSTEMS; James M. Wilson, Newark, N. J. App. filed Oct. 4, 1918. For automobiles.

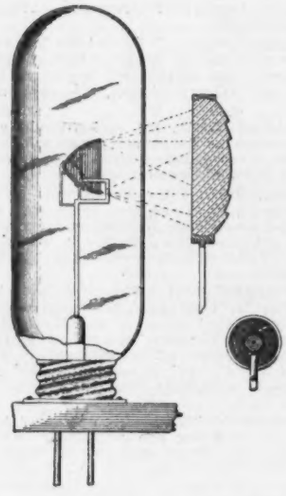
1,345,004. ELECTRIC BROILER; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 4, 1916. For broiling meats.

1,345,007. WAVE CHANGER FOR RADIO SIGNALING APPARATUS; Guy Hill, Washington, D. C. App. filed Oct. 7, 1918. For both transmitting and receiving.

1,345,015. COMPRESSION RHEOSTAT; Otto A. Knopp, Oakland, Cal. App. filed Oct. 16, 1916. Submerged in oil.

1,345,016. TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed July 22, 1918. For automatic and semi-automatic exchanges.

1,345,049. TELEPHONIC APPARATUS; Maximilian Weil, New York, N. Y. App. filed March 30, 1916. For use in noisy location.



1,344,429. Electric Lamp

1,345,054. AUTOMATIC TELEPHONE SYSTEM; Bernard D. Willis, Chicago, Ill. App. filed April 8, 1914. Controlling operation of automatic switches.

1,345,060. TELEMOTOR; Melvin B. Benson Superior, Wis. App. filed Dec. 3, 1918 Steering gear for vessels.

1,345,066. EXCESS-VOLTAGE PROTECTIVE DEVICE; Quincy A. Brackett, Pittsburgh, Pa. App. filed Aug. 8, 1919. Very delicate protection.

1,345,074. AUTOMATIC MINE-DOOR-OPERATING MECHANISM; William Crooks, Aldrich, Ala. App. filed July 17, 1919. Mine car automatically open doors.

1,345,080. FOOT-CONTROLLED ELECTRIC GOVERNOR; Harrison D. Flegel, Racine, Wis. App. filed May 24, 1919. For sewing machines, dental lathes, etc.

1,345,091. AUTOMATIC LOCKOUT FOR LAMP SOCKETS; Andrew J. Kellog, Acton, Cal. App. filed July 7, 1919. Prevents removal of lamp.

1,345,199. DIRECTION INDICATOR FOR AUTOMOBILES OR THE LIKE; Clyde W. Landers, Portland, Ore. App. filed Feb. 24, 1919. Illuminated.

1,345,212. ELECTRIC SAFETY LANTERN; James F. Monahan, Newark, N. J. App. filed Nov. 23, 1915. Safe in case of breakage.

1,345,222. ELECTRICAL HEATING AND COOKING APPARATUS; Cornelius G. Nobbs and Walter W. Nobbs, London, England. App. filed Dec. 26, 1918. Immersion heater.

1,345,249. ELECTRIC HEATER FOR STEERING WHEELS; Even J. Rohne, Minneapolis, Minn. App. filed Sept. 7, 1917. Hand warmer.

1,345,331. MAGNETO-ELECTRIC MACHINE; Henry W. Uhl, Freeport, N. Y. App. filed March 25, 1919. Removable distributer block.

(Issued July 6, 1920)

1,345,337. TOOL FOR TESTING SPARK-PLUGS; George H. Ainge, Springfield, Ohio. App. filed April 15, 1918. For testing plug on car.

1,345,348. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 25, 1917. Automatic ringing trunk.

1,345,349. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 25, 1917. Automatic trunk lines.